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EXAMINATION OF THE PETROLEUM INDUSTRY IN ALBERTA: SOME ASPECTS OF COMPETITION IN THE MOTOR GASOLINE MARKET

by

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled Examination of the Petroleum Industry in Alberta: Some Aspects of Competition in the Motor Gasoline Market, submitted by Andrew Celmainis in partial fulfilment of the requirements for the degree of Master of Arts.

ABSTRACT

It is the aim of this thesis to examine the pricing of petroleum products by concentrating on one product, namely automotive gasoline, and then comparing prices in Edmonton to those in Toronto. The petroleum industry has certain unique characteristics which affect pricing of products. The marketing of crude oil is essentially an exercise in the pricing of joint products since the basic crude oil stock can be made to produce a variety of end products. The large capital outlay necessary for exploration, development and production, the long payback periods, and the risks inherent in finding and developing markets for crude oil or refined products have led to an industry which is highly regulated at the production stage by conservation authorities, but an industry which is nevertheless powerful in administering its own prices, profit margins, and standards of performance judged to be fair and adequate for survival.

The result is an industry dominated by relatively few seemingly profitable "giants" surrounded by a number of "independents" who follow or accede to the policies and actions of the large firms. As a result, price variations between various parts of the country depend on the income ability of the various markets to absorb suppliers' prices.

They also depend on the effectiveness of the policy makers to regulate industry in such a fashion as to provide society with benefits arising from an efficient allocation of resources.

ACKNOWLEDGEMENT

The petroleum industry is important to the economy of Alberta. Many Albertans have been vitally concerned with any studies designed to increase their knowledge of the industry. Particular gratitude is expressed for the assistance of Dr. E. J. Hanson, formerly Head of the Department of Political Economy and now Associate Dean of Graduate Studies at the University of Alberta.

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CHAPTER I

THE PETROLEUM INDUSTRY AND ITS IMPACT ON THE ECONOMY OF ALBERTA

Petroleum has been known to man for many centuries but has found abundant uses only in the last one hundred years. Although it was formed millions of years ago and written about in ancient manuscripts, it was not until 1857 that the true era of petroleum consumption began. These mysterious hydrocarbon mixtures were rediscovered by James Miller Williams. He struck oil at a depth of sixty feet in a hand-dug well near Oil Springs, Ontario. Soon afterwards, a Colonel Drake claimed the first discovery in the United States. His well struck oil at a depth of seventy feet at Titusville, Pennsylvania. While both of these discoveries were nearly simultaneous, the advance of the industry in the United States has been much more spectacular than in Canada. This was especially true of the period before the 1940's.

Because the United States was more developed and had several prominent business leaders, development of many industries in the economy were rapidly taking place in the

late 1800's.

The petroleum industry was no exception. Especially noticeable was the influence of John D. Rockefeller and the powerful Standard Oil Company which he controlled from its inception in 1870 until the courts curtailed Standard Oil's power by ordering its dissolution in 1911. By that time, the companies formed from Standard Oil's fragments were able to proceed to develop a rapidly expanding industry. Development of the horseless carriage meant that gasoline was required as a source of power. Whereas previously kerosene had been the primary end-product because of its use as a source of light, now the demand for gasoline rose rapidly. Refining techniques had to be adapted to produce this commodity. The horseless carriage became widely accepted by all levels of society in the early 1900's. The need for gasolines has increased rapidly to the present time.

In the late 1800's and the early 1900's, Western Canada was developing rapidly and settlements were springing up almost overnight. The major settlements were close to the railroads and intercommunity transportation utilized the horse. The sparse nature of land settlement prevented local governments from building many roads because of excessive costs. The result was that the settlers had little use for cars even if they had been financially able to buy

them. The main petroleum product used was kerosene which was brought in from Ontario to provide fuel for the oil lamps. However, the quantity consumed was very small.

The railway companies were the first to find petroleum in Western Canada. Actually, the finds were accidental. The Canadian Pacific Railway was drilling for coal and water near Medicine Hat when the first natural gas was discovered. Almost immediately, the possibilities of using natural gas as a source of energy were explored. This actually deterred exploration for oil because few people realized that natural gas and oil could be found and used in conjunction with each other. Since the quantity of natural gas demanded far exceeded the quantity of oil demanded, the search for oil was not actively undertaken. Small finds were encountered during exploration for natural gas.

Little commercial development took place in the petroleum industry until the Dingman well resulted in the discovery of the Turner Valley field in 1914. Before this time, there were many pessimists who did not believe that oil and natural gas existed in large quantities in Alberta. Even more of a mystery was the fact that oil and gas could be found together. This pessimism caused oil firms difficulties because capital was not forthcoming. Many pioneer

"oil prospectors" had dreams but no financial resources with which to fulfill these dreams.

Following the discovery of the Turner Valley field, speculators began to take an active interest in the possibilities of producing oil in Alberta. The advent of World War I resulted in curtailment of exploratory activities. This was due to lack of speculative funds as well as lack of qualified personnel.

During the 1920's some automobiles appeared in Western Canada. Demand for gasoline resulted in a refinery being built by Imperial Oil in Calgary in 1921. Since the market was very small, there was little incentive for exploratory drilling. The 1930's brought the great depression when speculative funds dried up and incomes fell so that little demand for petroleum existed.

After the end of World War II however, there was new exploratory and investment activity. The need for future reserves and the rapid growth of markets brought American oil firms into Canada, particularly Alberta. With them came an almost unlimited volume of capital so that exploratory activity rose rapidly. In 1947, Imperial Oil brought in Wildcat #134 near Leduc as a producing oil well. This became the start of Alberta's era as a major producer of petroleum. The decade following the discovery of the Leduc

field was one of frenzied activity in exploration, production, transportation, refining and marketing.[1] During this decade most of the major fields were discovered: Redwater, Joarcam, Acheson, Golden Spike, Stettler, Bonnie Glen, Sturgeon Lake, Joffre, Pembina, Fenn-Big Valley and Wizard Lake. The major discoveries since the mid-fifties have been at Judy Creek, Swan Hills and Virginia Hills in the late 1950's and at Slave Lake in 1964.

Another source of oil, the tar sands in Alberta, must not be overlooked. This is perhaps one of the most important single areas in the world. The Athabasca tar sands were discovered by Peter Pond and Alexander McKenzie but little further exploration of this potential source of oil was carried out until very recent times. This can be attributed to the difficulty of developing an economically feasible technology and lack of sufficient markets within an economic geographic radius. The costs of extraction have exceeded the market price for the low grade asphaltic crudes found in the tar sands.

Recent favorable technology and pessimism regarding future supplies of crude from conventional sources has

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[1]Describing this decade is a book by E.J. Hanson, Dynamic Decade (Toronto: McClelland and Stewart, 1958). Its title very aptly describes the changing nature of Alberta's economy during this period.

caused a syndicate of firms to build a pilot plant at Mildred Lake in the Fort McMurray area.[2] The Alberta Oil and Gas Conservation Board recently allowed an application by Great Canadian Oil Sands Limited to build a 191 million dollar plant capable of producing 45,000 barrels of crude oil per day when operations begin in 1967.[3] However, two other applications were turned down in order to limit production from the tar sands until demand warrants increases.[4] Obviously, the Oil and Gas Conservation Board seems to feel there is a danger of overexpansion of facilities with no immediate markets which will create the needed demand.

While the foregoing has only highlighted the development of the petroleum industry as it is relevant to the Alberta situation, it should suffice to familiarize the reader with the industry to a sufficient degree to allow some numerical tables to be introduced to the study. While it is not the intention of this thesis to deal with the

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[2]Cities Services Athabasca, Inc., Richfield Oil Corp., Imperial Oil Ltd., and Royalite Co. Ltd. are presently conducting tests from this joint venture.

[3]Sun Oil Corporation has subscribed to approximately 35% of the shares to be issued to finance the plant. Citizens of Alberta are given priority on 7% of the shares with various other investors subscribing for the others.

[4]Shell Canada Limited and Cities Services Athabasca Limited made unsuccessful applications. See: Financial Post: April 11, 1964, p. 60.

aggregate impact of the whole petroleum industry upon the economy of Alberta, it is useful to point out some of the major effects.

Impact cannot always be measured in physical units which seldom allow adequate expression of such things as political power, prestige, or general contributions to the welfare of the area. These contributions may be monetary or in the form of services rendered. The important indicators of impact are readily measurable. Employment, income and investment are the most important.

Various estimates to measure the importance of the industry to Alberta have been made. Government agencies have done most of the work in this area but other contributions can be seen. Hanson's study is perhaps the most important.[5]

Hanson estimated that the petroleum industry caused the population of the three prairie provinces to be greater by 600,000 people than it would have been had the Leduc field not been discovered.[6] About one-half of this population increase occurred in Alberta. Hanson reasons that petroleum finds caused regional population growth which

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[5]Hanson, op. cit.

[6]Hanson, op. cit., p. 283.

could never have occurred if some such stimulus had not been provided. Before 1947, the prairies were losing population and the prospects for growth were very dim. The main sustaining factor in the economy, agriculture, was rapidly becoming mechanized and could not continue to provide increasing employment opportunities.

While much of the population increase could be attributed to the growth of the petroleum industry, direct employment in the industry was not very substantial. The increase in employment in the 1946-1956 decade for the petroleum and related industries in Alberta was about 22,000 people.[7] To reach Hanson's estimate of 300,000 population increase, it must be postulated that opportunities were created in other sectors of the economy because oil was discovered.

Caves and Holton, in a study of the Canadian economy, felt that the oil industry in Alberta did not have very much effect on employment and population growth, despite the publicity given to the oil boom. They used multipliers derived in Texas, feeling that the Alberta industry was still too immature to get accurate multipliers which measure the

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[7]For example, automobile repairing and petrochemicals.

true effects.[8] Using 1951 figures, they found that production and exploration employed 9,000 people and processing employed 1,000.[9] Value of production per worker was very high, however (approximately $61,000 annual output per worker). From observation in Texas, they found that each new job in oil and gas extraction created 1.71 new jobs elsewhere in the region. This would indicate that the 40% increase in employment in Alberta's petroleum industry from 1951 to 1961 would have created fewer than 7,000 new jobs in other sectors.[10] These figures would indicate little employment effects have occurred in Alberta. Examining the actual statistics of employment in related industries alone (such as petrochemicals) would suggest that Caves and Holton were overly conservative. The increased government revenues from oil royalties have caused the construction of new highways which require construction and maintenance personnel. Finance, trade and services have expanded enormously. These must be based on stimulating factors such as the discovery

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[8] Caves, R.E. and Holton, R.H., <u>The Canadian Economy</u> (Cambridge: Harvard University Press, 1959) pp. 206-215.

[9] <u>Ibid</u>., p. 201 and p. 206.

[10] This is based on employment increases derived from Dominion Bureau of Statistics employment data. Therefore, jobs created using the Caves and Holton multiplier are 1.71 x 0.40 x 10,000 = 6,840.

of vast quantities of oil. Without this, there are reasons to believe that population growth on the prairies would have been very slow.

If the effects of regional investment and income changes are analyzed, some evidence supporting the prominent role of the petroleum industry in Alberta can be detected. The impact of investment can be measured most accurately using input-output analysis and tracing through the multiplier effects of a given initial expenditure. Here it will suffice to examine the initial effects of investment by the petroleum industry and the final effects in terms of national income changes.[11]

Tables I, II and III illustrate the relationship of Alberta to the rest of Canada in terms of population and incomes.

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[11]The most accurate breakdown of regional personal income available is the breakdown from national figures using arbitrary regional percentages assigned by the Dominion Bureau of Statistics. The system has weaknesses but unfortunately, not enough research has been done in this field at the present time. An input-output analysis now being undertaken by the Dominion Bureau of Statistics may solve some of the problems. Provincial governments have ignored this area of data collection.

TABLE I

POPULATION OF ALBERTA AND CANADA--COMPARISONS AND GROWTH RATES FOR SELECTED YEARS[a]

Year	Population of Alberta	Population of Canada	% Increase in Alberta	% Increase in Canada	Alberta's Population as % of Canada's
1941	796,000	11,507,000	0.88	6.95	6.92
1946	803,000	12,307,000	17.06	13.84	6.52
1951	940,000	14,010,000	19.57	14.78	6.71
1956	1,124,000	16,081,000	18.51	13.41	6.99
1961	1,332,000	18,238,000	6.23	4.30	7.30
1963	1,415,000	19,021,000	. . .	. . .	7.44

Annual Rate of Increase in Population	Alberta	Canada
1941-1963	2.7%	2.3%
1946-1963	3.4%	2.6%

[a]Source: Dominion Bureau of Statistics, Canada Year Book (Ottawa: Queen's Printer, Annual).

Population growth in Alberta since the last World War has been very rapid. The average annual rate of increase has been 3.4% compared with the Canadian figure of 2.6% for the same period. The statistics tend to indicate some force has been responsible for this rapid population growth. Similarly, personal and per capita incomes have shown very noticeable increases. Accompanying these increases have been noteworthy changes in structure of the

TABLE II

PERSONAL INCOME IN ALBERTA AND CANADA FOR SELECTED YEARS[a]

Year	Personal Income in Alberta ($ Mil. Current)	Personal Income in Canada ($ Mil. Current)	Alberta's Income as % of Canada's
1941	$ 323	$ 5,851	5.52
1946	686	9,719	7.06
1951	1,228	15,824	7.76
1956	1,592	21,958	7.25
1961	2,142	28,049	7.64

[a]Source: Dominion Bureau of Statistics, The National Accounts (Ottawa: Queen's Printer, Annual).

TABLE III

PER CAPITA PERSONAL INCOME IN ALBERTA AND CANADA FOR SELECTED YEARS[a]

Year	Per Capita Income in Alberta ($ current)	Per Capita Income in Canada ($ current)	Alberta's Per Capita Income as % of Canada's
1941	$ 406	$ 508	80.0
1946	854	791	108.0
1951	1,308	1,130	115.8
1956	1,418	1,365	103.9
1961	1,608	1,540	104.5

[a]Source: Dominion Bureau of Statistics, The National Accounts (Ottawa: Queen's Printer, Annual).

Alberta economy. The transition from a predominantly agricultural base to one which is relying more on a wide variety of sectors has taken place. Both primary and secondary manufacturing have shown remarkable development in the last twenty years. The trade, finance and service sectors have increased in size and also as proportions of the total economy.

Examination of personal income statistics for Alberta is useful for indicating changes which have occurred within the province. Unfortunately, personal income figures do not reflect the true picture. Comparable statistics for Saskatchewan attest to the incomplete nature of personal income data.

For the 1941-1961 period, personal incomes per capita were remarkably similar in Alberta and Saskatchewan.[12] To state that the development of the petroleum industry in Alberta caused rapid income growth can be misleading unless qualified. Since both Alberta and Saskatchewan experienced noticeable hardships during the depression of the 1930's, the road to recovery was long and rapid increases in personal incomes were to be expected. Such was the case in the early 1940's. The depression hit the agricultural sectors

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[12]Calculated from Dominion Bureau of Statistics, The National Accounts, (Ottawa: Queen's Printer, annual). Tables 28 and 29.

very hard. Alberta and Saskatchewan which were primarily agricultural felt the difficulties much more than Manitoba which had some industrial development as well as distributional facilities to service the prairies. As a result, per capita incomes in Manitoba were somewhat higher than those in the other two prairie provinces.[13]

By the late 1940's, per capita incomes in both Alberta and Saskatchewan surpassed those in Manitoba.[14] A reasonable explanation for this recovery can be linked to the discovery of oil in Alberta. If the assumption of perfect mobility of labour is made, the equality of per capita incomes in Alberta and Saskatchewan can be explained. An exodus from agricultural sections of the two provinces to the urban centers occurred. Development of the petroleum industry brought other industries to Alberta. The resulting industrialization and urbanization occurred primarily in Alberta so that much of the labour force moved to urban areas of Alberta. The resulting adjustment in labour-land ratios in the various sectors of the two provincial economies could have helped to equate per capita incomes between the agricultural and industrial sectors. Total personal income rose rapidly in Alberta because of the increase in

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[13] Ibid. [14] Ibid.

population. Saskatchewan was gaining population at a slower rate than natural increases would warrant, meaning a net loss occurred through migration.

The per capita incomes in Manitoba lagged behind the other two provinces because labour mobility was not as great in that province. Less reliance on agriculture in Manitoba relative to Alberta and Saskatchewan meant that the noticeable postwar urbanization did not affect Manitoba to the same degree as the other two prairie provinces.

Even if the "spillover" effects of oil discoveries in Alberta indicate that Saskatchewan residents benefitted, some evidence that Albertans benefitted to a larger extent can be introduced by analyzing the role of the provincial governments. While royalties, leases and rentals brought large revenues to the Alberta government, Saskatchewan was not nearly as fortunate. As early as 1948, these sources of revenue added $13,000,000 annually to provincial revenues in Alberta.[15] By 1951, revenues rose to $40,000,000 annually and in the following decade, averaged about $110,000,000 annually.[16]

The petroleum industry in Saskatchewan began to

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[15]Alberta Bureau of Statistics, Alberta Industry and Resources, (Edmonton: Queen's Printer, 1964), p. 79.

[16]Ibid.

develop on a large scale approximately eight years later than in Alberta. Mineral rights in Saskatchewan have not yielded large revenues until very recent times. The difference in revenues from mineral rights and royalties between the Alberta and Saskatchewan is noticeable in the size of annual budgets presented in the two provinces. Alberta has had consistently larger per capita budgets than Saskatchewan and has invariably had a surplus on its budget operations.

The services provided by government expenditures in Alberta are unequalled in most parts of Canada. The added revenue caused by development of Alberta's oil potential has no doubt been influential in determining budget size. Provincial debts in Alberta were rapidly paid off when money from royalties and leases began to accumulate. Today, the province of Alberta is the only one in Canada with no net provincial debt.[17] The healthy atmosphere created by adequate provision of social goods can be a very stimulating factor for an economy. Revenues due to the development of the oil industry have been important factors in the large government expenditures in Alberta.

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[17]Municipal debt still exists. Municipalities have often advocated that some of the government surpluses should be used to help these municipalities to liquidate their debts.

TABLE IV

NEW CAPITAL INVESTMENT BY THE PETROLEUM INDUSTRY AND TOTAL INVESTMENT IN ALBERTA[a]

Years	Investment by Petroleum Industry ($000,000)	Net Investment in Alberta ($000,000)	Petroleum Investment as % of Alberta's	Adjusted Percentage[b]
1947-1951	$ 656	$1,726	38.0	14.1
1952-1956	1,741	3,602	48.3	18.0
1957-1961	2,591[c]	4,624	56.0	20.8

[a]Hanson, op. cit., Table XXIII, p. 251 and Table XXIV, p. 253.

[b]The investment figures for the petroleum industry include all outlays for land acquisition, exploration, development, transportation, refining and marketing. Hanson includes all of these factors while the Dominion Bureau of Statistics figures for net investment include only plant and equipment. Hence an adjustment was necessary to reflect the true comparison.

[c]Estimated.

The investment data examined in Table IV reveal that the petroleum industry has had a significant influence on capital expenditures in Alberta.[18] It can be seen that the petroleum industry is now responsible for about one-fifth of the total capital expenditures in Alberta. The rapid increase of investment in the early 1950's is also reflected

[18]Capital expenditures include only net investments in new plant and equipment ie. additions to stock.

in the rise in personal incomes for Alberta. Both total and relative income changes can be detected. How much of this is attributable to multiplier effects of investment is not altogether clear. However, the rising share of investment attributable to petroleum indicates that income rises are inevitable in the future.

Importance of the industry to Alberta's economy can also be measured by the value added method. Table V examines the value added by all manufacturing industries, by the petroleum industry and value of factory shipments for these two segments.

Using these data, it can be seen that the petroleum industry has been responsible for approximately one-tenth of the value added by all manufacturing if the post-1958 system of valuation is applied. Further de-emphasis of the impact of the petroleum industry has been caused by reclassifying petrochemical plants under the chemical products industry.

When the results of Table V are compared with capital expenditures in Table IV, the capital intensity of the petroleum industry becomes obvious. The relative importance of capital expenditures by the petroleum industry is approximately twice as important as the value of factory shipments when both of these values are compared to their

TABLE V

VALUE ADDED BY THE PETROLEUM INDUSTRY AND BY ALL ALBERTA MANUFACTURERS
VALUE OF FACTORY SHIPMENTS BY REFINERS AND BY
ALL ALBERTA MANUFACTURERS[a]

	Value Added in $000,000			Factory Shipments in $000,000		
Year	By Petroleum Industry	By Alberta Manufacturers	By Petroleum Industry as % of Alberta Total	By Petroleum Industry	By Alberta Manufacturers	By Petroleum Industry as % of Alberta Total
1950	12.0	123.9	9.7	38.6	402.8	9.6
1951	13.8	141.6	9.7	62.7	458.3	13.7
1952	22.4	178.2	12.6	76.0	518.4	14.7
1953	26.5	199.7	13.3	89.7	555.8	16.1
1954	38.4	219.3	17.5	101.7	575.3	17.7
1955	47.0	263.3	17.9	116.0	641.1	18.1
1956	51.9	285.8	18.2	132.3	703.2	18.8
1957	59.8	312.0	19.2	147.5	784.5	18.8
1958	27.9 (64.3)[b]	339.4	8.2 (18.9)[b]	105.4 (150.1)[b]	848.3	12.4 (17.7)[b]
1959	31.2 (65.4)[b]	346.3	9.0 (18.9)[b]	107.7 (150.6)[b]	887.3	12.1 (17.0)[b]
1960	31.8	353.2	9.0	107.6	889.7	12.1
1961	30.0	346.7	8.6	108.6	933.8	12.6

[a]Source: Dominion Bureau of Statistics, Canada Year Book (Ottawa: Queen's Printer, Annual), and Refined Petroleum Products (Ottawa: Queen's Printer, Annual).

[b]In 1958, a new system of valuation was introduced in the petroleum industry. Previously, the values reported more closely resembled wholesale prices rather than factory prices. Since distribution costs consisted of a large portion of wholesale prices, overstatement occurred. The bracketed figures designate the values using the old valuation system.

respective Alberta totals.

Investment outlays using the Hanson definition which includes outlays for all capital goods have exceeded revenues for the industry in Alberta for every year up to 1964 when the break-even point was finally achieved.[19] Reduced exploratory activity and increasing markets for products suggest that a surplus in overall industry expenditure-revenue accounts is inevitable. Much of this investment has gone to the petrochemical plants which have only recently begun to operate and sell products in large quantities.

While it would be useful and interesting to examine the whole petroleum industry in detail, it is virtually impossible to do justice to such a diversified industry in one report. Therefore, the industry will be broken down for the purposes of this study and only one type of product, motor gasolines, will be examined in detail.[20]

There appears to be some evidence that gasoline production in Alberta is a good indicator of industry trends at the provincial level. The high proportion of crude oil converted to gasoline in Alberta has no counterparts in the

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[19] Hanson, op. cit., p. 251.

[20] Motor gasolines include all grades of gasoline used in motorcars and tractors but exclude aviation gasoline and diesel fuel.

large Eastern Canadian market. Table A-I indicates that gasoline sales in Alberta have amounted to approximately one-half of all petroleum product sales while the comparable value for Canada has been about one-third.[21] This suggests heavier reliance on gasoline sales by Alberta refiners than by those in other parts of Canada.

Gasoline production can serve as an effective indicator of trends in the petroleum industry. In recent times, some concern about gasoline price structure has been expressed. Some apprehension regarding high gasoline prices in Alberta compared to Eastern Canada has existed. Examination of gasoline prices may help to determine whether cost considerations are important in pricing decisions. Pricing decisions can then be related to the structure of the petroleum industry to determine whether the industry is acting in a manner consistent with commonly accepted economy theory.

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[21] See Appendix Table A-I, columns 11 and 12.

CHAPTER II

THE STRUCTURE OF GASOLINE PRICES

It is difficult to analyze the price structure of an industry producing several thousand products by using a simplified index. The generalizations which would have to be introduced would defeat the purpose of the study of pricing. To allow some more specific information to be introduced, it is advisable to select one or more products and analyze these in greater detail. This study has selected motor gasolines to illustrate the procedures used in the pricing of petroleum products.

Gasoline was chosen for two reasons. It is the most familiar product produced by the industry. Also, it is the main product produced by the petroleum industry. Examination of industry statistics reveals that gasoline production uses 35 to 50% of the total crude produced in Canada. The refining industry in Alberta has not only produced gasoline from about 50% of the crude fed into the refineries, but the selling value of gasoline has been higher than for other petroleum products. In total, Alberta refiners receive about

60% of their total revenues from gasoline sales.[1]

Since gasoline forms such an integral part of the refining stage of the petroleum industry, pricing decisions affecting gasoline are made with great care. Most of the pricing decisions of the petroleum industry originate with refiners.[2] This stage of the industry is very important from the economic standpoint. Engineers may regard production, especially exploration and development as the vital cog in the cycle. Others may be concerned with marketing. The important thing to remember is that pricing decisions affect all of the various production stages. Similarly, pricing of one product affects pricing of all other products. The choice of gasoline pricing is not only designed to point out the prominent features of pricing in this industry but also to indicate the interactions which exist among the various products. It is important to remember that none of the decisions regarding gasoline pricing are made solely for their effects on gasoline prices or outputs. Most decision makers try to analyze the consequences of any decision not only for other products but also for other firms, industries and countries.

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[1]See Appendix, Table A-I

[2]See below, Chapter II.

In order to analyze the retail price of gasoline, it is necessary to analyze the composition of that price. That is, the various pricing stages need to be examined. The main stages are producing, refining, distributing and retailing. Some studies have also included a transportation stage covering the gathering of the crudes and shipping these to the refiners.

The producing stage as this study defines it, includes the physical production in the oil fields, the gathering and transporting to the refiner or to brokers who may act as middlemen. The main price to be considered at this stage is the so-called field price or price at the wellhead. This price takes account of field location and the quality of the crude oil. To get the delivered price at the refinery, the gathering, transportation and middlemen's commissions (if applicable) must be added to the field price.

The refining stage includes the physical and chemical transformation of the crude oils into finished petroleum products.[3] Included here are the necessary additives. The price applicable to the distributor is the tank wagon or the terminal price.[4] From this price, the distributor computes

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[3]Some products may be shipped to other industries (e.g., petro-chemicals, plastics) for finishing.

[4]The tank wagon price, as the name implies, is the

his margin to arrive at the truck tanker price. The retailer's price will depend on the transportation costs from the refiner. Hence, he is governed by the tank wagon price.

The price to the final consumer will depend on five factors: field prices, transportation charges, tank wagon prices, distributor margins and retail margins. If any of the five change, the consumer could feel the impact. The cost changes may or may not be passed on to the consumer.

The field price may not reflect the true costs of production. Rather it reflects the world prices for various crudes at refinery locations. Each grade of crude oil from a given well must be able to withstand competition from other wells which could supply a given refinery. The high-cost wells may turn out to be low-revenue wells simply because of their distance from the market.

A further consideration in determining the revenue structure for a given well's output is the maximum efficient rate of production (hereafter known as MER) and the maximum permissible rate of production (known as MPR). The MER is set by a conservation authority in the interests of maximum long run capture of the oil in place. This is an engineering

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price of gasoline in railway tank car lots. The terminal price is the price at the refinery and may be equal to the tank wagon price. It may be lower if the refiner's handling and loading costs are excluded from his quoted terminal price.

concept based on recovery methods, whether primary or secondary, so that maximum amounts of oil can be brought to the surface.

The MPR is set by a marketing or regulatory authority to ensure proper allocation of resources. This is an economic concept designed to stabilize long run prices of crude oil by preventing flooding of the market at times when discoveries are plentiful and shortsighted entrepreneurs desire to receive a rapid return on their investments.

In Alberta, the MER for most wells is in excess of the MPR.[5] In other words, most wells are operating at somewhat less than maximum efficient capacity because markets for crude oil are insufficient to absorb all of the available supply. Rather than allowing an equilibrium price to be established at lower levels, regulatory agencies have tried to hold prices at levels which insure some profits for all (or nearly all) wells.

Crude oil prices vary with quality. Quality is measured by the density of the oil, or the American Petroleum Institute (API) rating[6] and the foreign ingredients contained

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[5]Since 1948 the MPR has been less than the MER. It had dropped in Alberta to 39% of MER by 1958, after having averaged 61% for the previous nine years. See Borden, R. Royal Commission on Energy (Ottawa: Queen's Printer, 1960). Appendix E, p. 173.

[6]The American Petroleum Institute devised this rating

in the oil. Accordingly, a crude with a high sulphur content is "sour". Natural gas is often found with crude oils but is readily separated from the oil upon recovery.

The high grade light density oils contain a higher percentage of naphtha which is more readily convertible to gasoline than the ingredients of the "heavy" crudes which include more asphalt and often, contain sulphur as well. The latter are more useful for producing fuel oils and asphalt.

Before 1947, most of the Alberta crudes were of low quality, ranging from 10 API to 15 API.[7] The newer fields such as Leduc, Redwater and Pembina produce oils ranging from 34 API to 40 API quite consistently and hence are desirable for gasoline production.

Tables A-II and A-III[8] indicate that the average value of Alberta crude oil at the well-head has been somewhat higher than the corresponding value for all Canadian wells. This result is significant when one remembers that many Alberta crudes must be shipped sizable distances to

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system. It is an arbitrary scale measured in degrees and reflects density of the oil. High API ratings designate light oils and low API ratings designate heavy oils. Thus the higher API ratings are of higher quality.

[7]Hanson, op. cit., p. 53.

[8]See Appendix.

find markets. Since Alberta has produced up to 96% of total Canadian crude oil production,[9] this indicates that the crude produced in other parts of Canada is substantially lower in quality. A rough rule of thumb used in the industry to determine price differences for crude oils is that a one degree API rating difference yields a two cent per barrel price differential.

For comparative grades of crude oil, the Alberta average well-head price is among the lowest in the Western hemisphere.[10] A 36 API Alberta crude was valued at $2.63 per barrel at the well-head when comparable crude in the United States Midwest sold for $3.05.[11] The differential can be explained by proximity to markets.

In order to compete in the Montreal market, Alberta producers would have had to (in 1958) accept $2.27 to $2.46 per barrel at the well-head.[12] Since the estimated production costs were greater than these values, it was not (and still is not) possible for Alberta crude to compete in the Montreal market unless tariffs or subsidies which favor Alberta crudes are imposed.

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[9] See Appendix, Table A-II

[10] Davis, J., Oil and Canada-United States Relations (National Planning Association monograph, 1959), p. 24.

[11] Ibid. [12] Ibid.

Since crude oil prices are set by a conservation agency which tries to relate these prices to the world prices for the corresponding grades of oil, any producer can sell all of his allowable quota at the set price. There is little to be gained by giving price or service concessions to buyers because of the homogeneity of a given grade of crude oil and the existence of a ready market for all of the allowable quota. Each well in each oil field is rated according to the cost of developing the well and the potential oil in place so that the allowable quota bears a relationship to economic and engineering concepts.

Two types of allowances are set for Alberta crudes. The "initial economic allowable" rate was separated from the "operating allowable" rate in 1961 by the Oil and Gas Conservation Board using 1955 as a base period. The purpose of the initial rate is to allow a more rapid recovery of some of the investment in the well during its first seven years of production. After that time, the allowance becomes approximately two-thirds of the initial allowance. Wells which were "designated"[13] before the 1955 base period were converted to the operating allowance on January 1, 1962. Wells designated since that time are converted on January

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[13]That is, wells which are officially recognized as producers by the Board.

first of the year following seven complete years of production. In other words, wells designated in January can operate almost eight years on the initial allowance rate.

The allowances for each well change with each new bulletin issued by the Board. If producing wells increase at a faster rate than the market demand, all previous wells are likely to suffer cutbacks in their MPR, unless conversion from one allowance to the other is able to offset these forces. Typical allowables are summarized in Table A-V.[14]

Because the largest portion of Alberta crude is exported from the province about (80% in recent years),[15] the gathering systems are oriented towards the major pipeline systems serving Eastern Canada and the West Coast. Since Edmonton is nearly the geographic center of a number of major oil fields, the Interprovincial Pipe Line begins at this point. This has important implications for the refineries in the city.

Large volume gathering systems are considerably cheaper to operate than small volume systems which must often rely on tank trucks instead of pipelines for gathering. Refineries in Edmonton benefit from the Interprovincial

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[14]See Appendix, Table A-V

[15]See Appendix, Table A-I and A-II

Pipe Line by being able to buy delivered crude oils at 6¢ to 17¢ per barrel higher than well-head prices.[16] This is one of the cheapest rates available to a refiner located in a marketing area.

It is difficult to examine the average well-head prices of all grades of crude oil because numerous prices exist. Each API rating and content of foreign ingredients influences price. Higher quality crudes (above 33 API) have usually been valued in excess of $2.50 per barrel at the well-head. Low API crudes (8 - 12) used primarily for asphalt were recently valued at $1.00 per barrel at the well-head.[17]

Using a 36 API Alberta crude with a well-head price of $2.63 per barrel for illustration purposes, it is found that an Ontario refiner would have to pay $3.38 per barrel for the crude in Sarnia and $3.45 per barrel delivered in Toronto.[18] To these charges must be added the average cost of other materials such as additives which averaged $0.50 per barrel of crude used.[19] The volume of additives is

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[16]Simpson, R.A., et al, A Survey Of The Petroleum Industry In Canada, 1961 (Ottawa: Queen's Printer, 1963), p. 53.

[17]Ibid., p. 70.

[18]Davis, op. cit., p. 24.

[19]Computed from Tables A-I, A-II and A-III, Appendix

approximately equal to refinery losses so that one barrel of crude oil yields approximately one barrel of products.[20]

Because many high value specialized products are not made in Alberta, the average cost of other materials is lower in Alberta than in Ontario. The refiner in Alberta pays $0.46 per barrel for these materials and about $0.15 per barrel for transportation costs.[21]

If the total cost of all materials and all grades of crude is considered, the average price in 1958 to the refiner in Alberta fell to $3.05 per barrel output while the Ontario price was $3.92.[22] The chief reason for the larger divergence between Alberta and Ontario prices when all grades of crude are considered is the low value of asphaltic crudes and other low API crudes suitable for fuel oils. These are partly refined in Alberta and then shipped to Ontario. Only the higher grades of crude oil are shipped to Ontario in a "raw" state.

Examination of the value added by the refining pro-

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[20]Both of the volumes are negligible relative to crude oil used. The offsetting forces are evident from the statistics of inputs and outputs.

[21]Computed from Tables A-I, A-II and A-III, Appendix

[22]The 36 API crude cited before would be priced at $3.45 + $0.50 = $3.95 per barrel in Toronto.

cess in Alberta and Ontario reveals that the Alberta refiner added $1.01 per barrel input while the Ontario refiner added but $0.65 per barrel to the value of the original crude oil.[23]

The difference can be explained by two factors. The main reason for higher value added per barrel in Alberta is the heavy reliance upon gasoline, a high value product. Gasoline production in Alberta accounts for about one-half of total production by volume whereas in Ontario, refinery production of gasoline is only one-third of the total production by volume. Motor gasolines require more expensive refining techniques because of recycling to increase ultimate recovery from a given crude. The value added per barrel is bound to increase with proportionally higher production of gasoline.

The second important difference can be explained by the role of scale economies. Given the present views regarding the optimum size of plant, both Alberta and Ontario are operating at less than optimum output.[24] The aggregate

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[23]Computed from Tables A-I, A-II and A-III, Appendix

[24]The largest refineries were built in the Bayonne, New Jersey area by Standard Oil who have found costs have fallen with increasing output. The lowest cost can be achieved at 120,000 b/d capacity according to the President of Standard Oil of Indiana, testifying before The Petroleum

cost curves facing many industries are downward sloping so that buying large quantities of factors can lower costs per unit. Where such is the case, expansion of capacity in the long run may allow not only scale economies but also decreasing costs as the firm moves along the downward sloping part of the "envelope curve". Therefore, smaller refiners are faced with higher fixed costs because they are not able to operate at short run optimum output. In the long run, the smaller refinery operator has higher costs as well because the quantities of factors which he buys must be shipped in smaller lots, necessitating more handling charges and hence a higher price.

It is not always possible to postulate what prices would be if a firm would operate at outputs other than that at which it is now operating. Because most firms are operating at less than capacity outputs, their costs in the short run would presumably fall as available capacities are more fully utilized. Large output changes could disturb

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Study of the House Committee on Interstate Commerce, 86 Congress (1958). He suggested a 30,000 b/d capacity was a minimum size for employing present technology in an efficient manner. Some refineries producing only specialized products could be profitable even at outputs as low as 1,000 b/d. Cost estimates made by the Chase Manhattan Bank - Future Growth and Financial Requirements Of The World Petroleum Industry, 1956 found lowest operating costs to be in refineries having capacities exceeding 100,000 b/d.

the price structure in such a way that competitors are forced to alter their output as well. The ultimate solution is never easy to predict. Pricing changes may have to be made not to influence present competitors but to exclude potential competition. Oligopolists not regulated by public authorities prefer to maximize their profits. To do so, they probably do not produce at minimum average cost. Even if they do, they are not likely to sell products at minimum average cost because of the downward sloping demand curve facing the firm.

Capacity of a petroleum refinery will be defined as that output which can be produced at minimum total cost in the short run. Excess capacity would exist for any refiner not operating at optimum output in the short run. By using this definition, it is postulated that the short run cost curve becomes vertical at minimum average costs i.e. at capacity output. That is, capacity is measured by the amount of throughput in a twenty four hour period. It is then impossible to operate at higher than capacity output.

Alberta refiners have lower-average variable factor costs for a comparable unit of output than Ontario refiners because of proximity to sources of crude oil, the major component of the total factor input mix.[25] The offsetting

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[25] About 80% by value of all variable factor costs

features are the higher costs of utilizing the smaller plants. Since fixed costs must be apportioned among units of production, larger outputs will reduce fixed costs per unit. If some factors such as additives are also available at cheaper rates when bought in bulk, the refiner can find that considerable savings are available if market conditions would allow larger plants to operate.

The tank wagon prices in Ontario and Alberta cannot be compared per se because each refining area posts its own price. Toronto and Edmonton are chosen as representative of their respective provinces.[26] The tank wagon price in Edmonton of 20.4¢ per gallon is 1.6¢ lower than in Toronto. Comparable values for other selected cities are given in Table VI.

TABLE VI

TANK WAGON PRICE OF REGULAR GASOLINE IN CENTS PER GALLON[a]

Montreal	22.3
Toronto	22.0
Winnipeg	22.4
Regina	21.7
Calgary	21.4
Edmonton	20.4

[a]Source: Hanson, op. cit., p. 173.

(crude, additives, power, labour) go to crude producers and

The pipeline tariff from Edmonton to Toronto at this time was about 67¢ per barrel or 1.9¢ per gallon.[27] The comparison of tank wagon price differentials to crude price differentials cannot yield meaningful results because of the differing product mixes being produced in Edmonton and Toronto. However, one can conclude that Ontario refiners can quote a very slightly lower tank wagon price than the crude price structure would allow. The quoted tank wagon price may be due to one of two factors. The costs of refining could be sufficiently lower to allow this price differential. Alternatively, the refinery margin in Toronto could be lower than in Edmonton. The lower margin can be forced upon a given refiner in Toronto by the presence of active competition resulting from actions of six refiners. In Edmonton, three refiners operate but Imperial Oil controls about 60% of the capacity compared to about 37% in the southern Ontario region.[28]

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transporters. Dominion Bureau of Statistics, Petroleum Refineries, (Ottawa: Queen's Printer, Annual).

[26]Each is a major refining and marketing center.

[27]Davis, op. cit. As fixed costs of the Interprovincial Pipe Line are being recovered, pipeline tariffs have fallen. At present, the tariff is 54¢ per barrel. See Simpson, op. cit., p. 53.

[28]Simpson, op. cit., pp. 64-66. While three refiners are located in Sarnia, they sell their products in the Toronto area. Edmonton refiners do not meet such competition from

It is difficult to justify such a small price differential between Edmonton and Toronto tank wagon prices. If economies of scale are responsible for the price differentials, there is little cost reduction to be gained by increasing utilization of plant capacity. While the firms in the industry are reluctant to admit it, the refinery margin in Edmonton has been higher than in Toronto.[29] The justification for the higher margin in Edmonton lies in the product mix being produced. Because the demand for specialized lubricants is small in Edmonton, refiners have found it is unprofitable to produce them. But they are sacrificing high margin products in the process and hence must of necessity charge higher prices for other products to enable operations to show profits compatible with those in Eastern Canada.[30]

The need to show profit margins on gasoline in lieu of products which would allow higher profit margins has caused regional divisions of national or international

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Calgary refiners.

[29]Personal interview with J.N. Love, Alberta sales Manager, Imperial Oil Limited, November, 1964.

[30]It was pointed out to me by J.T. Koskie, Regional Sales Manager, Imperial Oil Limited, Edmonton, that each refinery tries to meet target profit rates set out by the head office. These targets were set with the role of competitive forces kept fully in mind.

companies to pursue policies with painstaking care. Rather than attempting to increase sales revenue by expanding into markets served by sister divisions, refiners have concentrated their efforts to insure that prices can be held sufficiently high in their own marketing areas. Competing with sister divisions has not been deemed profitable, implying that national firms have located refineries at sufficient distances from each other so that multiplant economies exist. There is nothing to be gained by one refiner supplying another refiner's territory unless he can do so at a greater profit for the parent company. If such is the case, location of one of the refineries was not economically sound.

The major refineries in Alberta are owned by major integrated firms, many of which have worldwide operations. Because Alberta operations constitute a relatively minor share of total operations, less emphasis is placed on pricing of Alberta products than could be the case if the Alberta makret was an important source of revenue for these refiners.

The dominant position of Imperial Oil Limited at the refinery stage of production has not been seriously challenged by any of the other refiners.[31]

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[31]See for examples the submission by R.A. Harfield of Pacific Petroleums Ltd. to the Royal Commission on British Columbia Gasoline Prices. (Hearings, St. John, B.C.).

Having the largest refining facilities and being favorably located to supply most of Alberta, Imperial Oil is in an ideal position to "interpret economic trends and adjust its tank wagon price when cost conditions or competitive forces warrant."[32] But, the ability to compete in several areas of Alberta hinges on the successful negotiation of trading arrangements.

Imperial Oil Limited has indicated that the present tank wagon prices in the Edmonton area allow its Edmonton refinery to operate at a profit on invested capital despite some excess capacity.[33] Whether excess profits exist may be difficult to determine without making a value judgment about the level of acceptable profits. The remarkably stable prices at the refinery level do suggest that a profit maximizing price may have been achieved by Imperial Oil. Other firms have not taken steps in the past to alter a tank wagon price until Imperial Oil Limited has decided to do so. Whether price stability is due to the dominance of Imperial or to tacit understanding cannot be readily determined.

Examination of price changes at the refinery level reveals that Imperial Oil led both upward shifts in 1953

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[32] Ibid.

[33] Interview with J.N. Love, Alberta Sales Manager, Imperial Oil Limited.

and 1961 and a slight downward shift in 1957. Within days, all other refiners had followed the lead of Imperial Oil.[34] It is interesting to note that none of the other companies had signified any intentions of adjusting prices until Imperial Oil made the announcement. Almost immediately, all of the competing refiners took steps to match the price changes.

It is interesting to observe the price structure of refined products at the refinery. Alberta refiners sold products destined for resale in Alberta at an average price of $5.00 per barrel but the value of all Alberta refinery products sold averaged only $4.22 per barrel.[35] Herein lies the difficult pricing problem facing Alberta refiners.

In Alberta, the demand for fuel oils is very low. Natural gas is much cheaper and more convenient because distribution by pipeline does not require storage facilities at each outlet.[36] Fuel oils are necessary by-products of

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[34] Report prepared for Mobiloil by J. Harrington, Calgary, 1961 (mimeographed).

[35] Computed from Tables A-I, A-II, and A-III. Appendix, . . The Ontario refinery value of all products was $4.79 per barrel and the Canada average was $4.45 per barrel.

[36] Piping fuel oil could be feasible if it was available in widely separated areas of the province. Since refineries are not as plentiful as natural gas fields, the pipeline network would have to be very extensive.

the refining process. They can be recycled to produce more gasoline but costs rise at an increasing rate with each re-cycling stage. Ontario is deficient in fuel oils so that the Alberta refiner finds it is more profitable to accept "low" prices for the fuel oils than to recycle them. Competition from other sources of supply has forced Alberta refiners to receive $1.70 to $3.50 per barrel depending on the grade of fuel oil.[37] The low refinery prices of the fuel oils have kept the average value of refinery products produced in Alberta lower than those produced in Ontario. If Alberta fuel oils had a ready market in the province, the average value of refinery production would rise substantially. To show a profit for the refinery, the prices of other products must be high enough to absorb the apparent losses incurred in selling fuel oils.

The industry in Alberta has operated on the principle that gasoline production must absorb more than proportionate amount of production costs because fuel oils are unable to absorb their proportional share. In Ontario, industrial lubricants of various types have found a ready market so

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[37]After deductions for transportation charges which have been at least 50¢ per barrel by pipeline. The selling prices of fuel oils at the refinery level in Ontario have been $2.20 to $4.00 per barrel. See Dominion Bureau of Statistics--Petroleum Refineries, op. cit.

that most refiners can afford to sell gasoline at lower profit margins. They use gasoline sales to create demand for complementary products, such as motor oils and greases.[38]

Distributors have little direct influence in pricing. Most distributors are merely subsidiaries or departments of the refining company operations. The agents may work on a consignment basis, straight commission or salary. The effect on gasoline prices does not matter. The accepted markup at the distribution level is about 2.5¢ per gallon exclusive of transportation costs from the refinery. The range is usually from 1.5¢ to 3.0¢, depending upon volume and transportation charges from a rival refinery.[39] Where rival refineries are widely dispersed, transportation charges vary for each brand of gasoline. In Alberta, most of the capacity for gasoline production is found in Edmonton and Calgary refineries. There are trading arrangements which have assured that a given distributor's margin depends on volume rather than need to absorb transportation charges.

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[38]It was pointed out to me by J.N. Love, op. cit., that the industry does use cost allocation formulas and therefore the firms are concerned with price schedules which will increase total profits. Low margin goods can be used to create demand for higher margin goods. The result means that a profit maximizing solution is approached.

[39]Cassady, op. cit., p. 235. Discussions with bulk dealers for Texaco, Imperial and Shell have confirmed this.

Trading arrangements have been effective in stabilizing prices in a given area. The system is a version of basing point pricing with the added provision that the nearest refinery provide any brands of gasoline specified in the arrangement. A refinery produces enough gasoline to supply not only its own trading outlets but also those of competitors who have no refining facilities in the area. The saving in transportation costs can ultimately result in lower prices to the consumer. Trading arrangements have proven to be necessary in Alberta where only two refiners operate in both northern and southern areas of the province.[40] The other refiners have to rely on trading arrangements or face the possibility of absorbing transportation cost differences between their refineries and those of the nearest competitor, especially if that competitor is one of the major refiners.

Successful operation of trading arrangements insures that truck tanker prices in any region will be competitive regardless of the brand name being sold. Trading arrangements can be used only when the agreements among the firms involved is fully understood by all. This in turn implies that some collusion is a necessary ingredient. In most cases, mutual agreements may be in force through verbal

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[40]Imperial Oil and British American Oil maintain refineries in Edmonton and Calgary.

rather than written understanding. Unwritten orders can be effectively enforced by strict disciplining such as threat of price wars or discontinuing sources of supply but these orders can escape detection by regulatory agencies because it is difficult to gather evidence.

The retailer is faced with a set truck tanker price. He may be able to get a discount from this price if he sells what is known as "unbranded" gasoline.[41] Sellers of branded gasolines have limited choice of action. They may buy from a given refiner on the refiner's terms or close down altogether. They cannot buy from another refiner in the short run because these retailers do not have full control of their facilities. Some retailers are merely salaried agents of the refiner. Others are lessee dealers while still others own their premises but do not have free use of the installations provided by the refiner. Refiners provide the dispensing equipment, specified maintenance and use of the brand name in return for a contract for exclusive supply of products. If the retailer desires to terminate a contract (which is usually indefinite unless specifically stated), he becomes liable for specified charges resulting from upkeep

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[41]That is, gasoline not bearing one of the major refining company brands. Unbranded retailers may buy from various distributors. These may be owned by the refinery, may be independent or may be co-operatives owned by the retailers.

of the premises. These may be waived at the refiner's pleasure only.

The retailer is effectively facing a monopolistic price because he can buy from only one source (unless other specified by the refiner) and must pay the truck tanker price. He is in no position to alter the price because his position in the market is too weak and no other alternatives exist.[42] The price at which the retailer sells his products is "suggested" by the refiner. The retailer finds that failure to comply can mean almost immediate suspension of his franchise.[43]

The effect of "suggesting" a retail price is not much different than enforcing a retail price by direct means. Antitrust laws outlaw resale price maintenance per se but their interpretation of such administered prices has been rather lax. Each refiner tries to meet the price of competitive brands right to the nearest one-tenth of a cent per gallon. While input costs may be similar for all refiners, it is doubtful if they are exactly the same. Fixed costs

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[42]Except to sell unbranded gasoline.

[43]The MacGregor-Shell Oil dispute of 1963 in Edmonton indicates the suddenness and finality of oil company decisions. See the submission of January 20, 1964 by the Automotive Retailers Association of Alberta to the Alberta Government (mimeographed), p. 12.

undoubtedly vary for each. Therefore, the desire to maintain retail prices at a given level must exist for all refiners. Understanding the level of that price entails a certain amount of common knowledge. At the same time, the importance of one firm cannot be overlooked. It is reasonable to assume that all retailers are faced with the same type of policy. Most refiners are not anxious to take on retailers who have discontinued relations with other refiners unless amicable severance occurred.[44]

The oil companies have tried to set up their own retailing facilities in Alberta. Independent retail service stations accounted for 58% of all stations in Alberta in 1958, compared to 75% in 1951. Leased stations were 26% of the total (13% in 1951) but each leased station handled about six times as much gallonage of gasoline as the average independent station.[45] For example, Imperial Oil sold 36% of its gasoline through leased stations which accounted for only 14% of Imperial's total stations in Alberta.[46]

The advantages of controlling retail outlets are many. Of primary importance is the ability to maintain price and service policies advocated by the integrated refiner. Capital requirements can be supplied by large refiners at

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[44] _Ibid._

[45] _Ibid._, p. 10.

[46] _Ibid._

cheaper rates than could be obtained by private investors. Refiners have freedom in locating outlets designed to penetrate the market in an orderly fashion. The retailer can benefit by being able to invest only a small amount of his personal resources, thereby making it easier for him to get out of the business if he so desires. He has the use of company experts to deal with any problems which are beyond the scope of his business knowledge.

Another type of retail outlet must not be overlooked. This is the independent retailer who sells "unbranded" gasolines. While the specifications for these gasolines may not be very different from a refiner's regular brand specifications, the price at the refinery differs by about 2¢ per gallon. The official explanation for this difference is the need for refiners to pay advertising expenses for branded gasolines which are not needed for unbranded gasolines. Few retailers of branded gasoline do any additional advertising whereas retailers of unbranded gasoline may be required to do so if they desire to establish brand preference among consumers. In actuality, retailers of unbranded gasolines have elected to pass the cost savings to the consumer in the form of lower prices.

Independent retailers rely on favorable location, lower prices and service inducements to retain a share of

the market. Larger department stores have stressed the convenience of location factor in their gasoline sales which are usually supplemented by full service station facilities.

Independent retailers can guarantee their customers gasoline but cannot always guarantee a gasoline from a certain refiner. They rely on temporary excess supplies existing at a given refinery or else negotiate contracts which help a certain refiner to expand the use of existing capacity. In return, the refiner may be able to offer these retailers a price more closely approximating marginal cost because he wants to keep the account or because he is not worried about the competition which unbranded gasolines can provide. Retailers of unbranded gasolines are known to "shop around" from time to time to take advantage of "bargains" offered by the various refiners.

The typical price structures of a gallon of gasoline in Edmonton and Toronto can be summarized in the following table. Beginning with the crude price at the well-head, a final price to the consumer is derived by adding the value of production at the various stages. The figures quoted are approximate and do not take account of periodic variations. The 39.2¢ per gallon price is applicable to all branded gasolines sold. That is, the average price of regular gasoline (37.9¢) is weighted with that of premium grades

TABLE VII

TYPICAL STRUCTURE OF GASOLINE PRICES IN EDMONTON AND TORONTO

	¢/Gallon	
	Edmonton	Toronto
Well Head Price of Crude Oil (Alberta average for 36^{o} API)	7.5	7.5
Transportation and Gathering Charges	0.4	2.3
Refinery Value Added (Average for Gasoline)	5.0	4.7
Refinery Price	12.9	14.5
Refinery Handling and Transportation to Distributor	4.3	5.3
Distributor Tank Car Price	17.2	19.8
Distributor's Margin	2.5	2.5
Dealer Tank Wagon Price	19.7	22.3
Retailer's Margin	6.5	5.8
Price Exclusive of Tax	26.2	28.1
Provincial Tax	12.0	13.0
Federal Tax	1.0	1.0
Retail Price	39.2	42.1

(currently selling for 42.9¢ per gallon).

Retail prices in various areas of Alberta are closely related. In most cases, the transportation charges from

Edmonton or Calgary are governing factors determining the retail price structure. Retailers in the extreme limit of the Edmonton trading area, the Peace River block of northwestern Alberta, abide by the area pricing formula despite the existence of a refinery in Taylor, B.C. and former existence of a refinery in Grande Prairie. The need to follow the price leader is the official explanation given for adhering to a price formula which is 4.0¢ to 4.5¢ higher than Edmonton rates.[47]

Transportation charges do not explain the structure of prices in Red Deer. The transportation charges from Edmonton average less than 3¢ per gallon but Red Deer retail prices are about 4¢ higher than those in Edmonton. However, Red Deer is supplied by Calgary refiners whose tank wagon prices are about 1¢ per gallon higher than those in Edmonton. While Calgary refineries have higher average costs, marginal costs are lower thereby allowing sale of products in Red Deer at a higher profit to the company operating refineries in Edmonton and Calgary than supplying Red Deer from Edmonton refineries would allow. Therefore, the residents of that

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[47]Pacific Petroleums Ltd. submission to the British Columbia Royal Commission on Gasoline Price Structure indicates that Imperial Oil is the undisputed leader even in the Peace River block and Pacific prices its gasoline at a rate which allows competitors to haul from Edmonton.

area are paying a somewhat higher price than competitive conditions would warrant if free market forces could displace the quasi-agreements and resulting administered prices.

The examination of pricing gasoline reveals the rigidity which can arise if powerful firms are able to control a key stage. Such is the case in Alberta. Realizing that non-price competition can more than offset price competition in terms of ultimate cost to the producer, it is nevertheless interesting to observe the effects of price competition.

The producing stage cannot be easily manipulated by price policies of the large integrated firms. Not only are there many firms which make agreements difficult to enforce but also conservation agencies prorate supply to market demand, thereby effectively setting the price.

In some areas, the transportation stage is an important area where price policy can be effective. Where transportation charges are small relative to total costs, the savings to be achieved may be too small to warrant action. Alberta refiners are close to sources of raw materials so that transportation charges are minor components of total cost.

The production stage where price manipulation is easiest to achieve is the refining stage. Few firms are

found in any given market. Therefore, each firm may have some market power which it can use to further its goals. Because other firms are affected, retaliation can be expected. To keep all firms happy, some type of agreement, whether implicitly stated or not, results. Inasmuch as a dominant firm exists, the agreement may be drawn up with the dominant firm as one party and all other firms as the other party. Variations where several leaders exist may also occur.

The refiners decide the retail prices to be charged. Where distributors and retailers are closely tied to the refiner through financial or contractual means, the adherence to refiner "suggested" prices becomes a matter of course. Where more independence exists at the dealer or retailer level, prices adjust because of the potential threat which refiners can use. If some firms decide to pursue their own price policies, price wars are inevitable. These are usually bitterly fought and costly for all participants. Where they can be avoided, firms will benefit in the long run.

The Alberta market has operated for many years with very few price changes. While this has helped to keep many small and perhaps inefficient firms from the cost standpoint in the industry, there is little indication that prices have

been unnecessarily high. The 0.3¢ differential between Ontario and Alberta retail prices is hardly enough to justify concern. How much non-price competition relative to other areas has occurred in Alberta is difficult to measure in dollar terms. The continued operation of seven refiners for more than a decade indicates that either Imperial Oil has managed to hold prices sufficiently high to allow all of these firms to cover costs or that little actual cost differences among refiners exist. The validity of the former finds more application to the Alberta case. Since price leadership is a very common type of marketing arrangement in this industry, it is reasonable to conclude that one company can interpret trends for the industry.[48]

The setting of uniform retail prices by all firms is not really as difficult as would at first seem. The cost of a given quantity of crude oil is fixed for all refiners so that the valuation of the output has a large "fixed" element already. The refiner's price will depend on his costs of operation and profit margin. When crude prices change, the final consumer may be faced with a price change which is

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[48]For further information about pricing of petroleum and price leadership, see Alderfer, E.B. and Michl, H.E.--Economics of American Industry (New York: McGraw-Hill), 1957, pp. 276-281; and Lanzillotti, R.F. et al, Pricing in Big Business (Washington: Brookings), pp. 79-96.

greater than the change in crude prices. If refiners, distributors and retailers all maintain the same percentage markup, an upward shift in crude prices can cause a larger upward shift in absolute terms for the consumer without any collusion on the part of refiners. Profits can increase at the various production stages with the old price agreements still in effect. If one firm decides to alter its margin so that it retains the same absolute margin, the consumer could be spared the "pyramiding effect" if the other firms follow.

As long as crude oil prices are important in deciding the price of petroleum products in a given market, we can expect that product prices will fluctuate with crude oil prices rather than the effects of competitive firms.[49] Where instabilities arise, they are of temporary nature and are cured as the causes of these fluctuations are corrected.

The behavior of the petroleum industry can be explained if its structure is examined. To do so, the structure of the industry not only in Alberta but also in Canada has to be analyzed. The next section attempts to isolate some of the features found in the petroleum industry so that an analysis of the performance of the industry can be related to accepted economic theories. Reasons for pricing decisions may become obvious when some of the features of the industry

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[49] Alderfer, op. cit., p. 279.

are unfolded.

CHAPTER III

THE STRUCTURE OF THE PETROLEUM INDUSTRY

Institutional factors explain many of the phenomena found in an industry. When examination of an industry operating in a region is made, it is not enough just to limit the study to the region in question. This is particularly apparent in the petroleum industry where actions taken in Alberta are usually closely related to actions taken elsewhere. Many of the decisions made in the petroleum industry are made in places other than Alberta. While many of the smaller producers maintain head offices in Alberta, most of the large integrated firms have either the Canadian head office located in Eastern Canada or head offices located in other countries.

The Alberta petroleum industry produces more crude oil than it does finished products because crude is produced for export but most finished products are for provincial uses only. The structure of the industry is orientated towards the producing phase. More emphasis is placed on exploration and development of producing oil wells than is placed on large capacity refineries to produce finished

goods. This has been changing with the development of the petrochemical industry in Alberta which requires petroleum products in a semi-finished state rather than raw crude oil.

When the structure of a market is being examined, it is very important to define which market is being referred to. In the case of the petroleum industry, the market is different for every stage of the production process. Whereas the market for crude oil extends to Eastern Canada and many of the states in the United States, the market for gasoline at the retail level may only extend for several miles surrounding a retail outlet.

It is not always a simple matter to define and delineate a market. A simple definition such as the one given by Bain[1] defines a market without really saying how to determine where one market ends and the other begins. He says a market is simply a "closely interrelated group of buyers and sellers". In order to find the limits of any market, relations of all buyers and sellers must be examined. Cross-elasticities of demand can be used as guides but absolute boundaries between substitute goods and unrelated goods cannot be determined by values of cross-elasticity or any other method. The boundaries are hazy and the transition from one

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[1]Bain, J.S., Industrial Organization (New York: Wiley, 1959), p. 7.

market to another may be open to some dispute. That some boundary exists cannot be denied, if some delineation of markets is necessary for policy purposes.

Massel has tried to define a market using eleven different indicators.[2] Each of the indicators would yield different results and no two indicators, except by coincidence would be likely to yield the same answer. The dimensions of a market change with changes in the relative prices of the various goods, changes in the characteristics of the products demanded, changes in buyers' preferences, changes in incomes, and competition from new sources whether new or existing firms, factors or products.

If a market consists of interrelated buyers and sellers, their relationships with each other constitute the structure of that market. The most common concepts encountered when an analysis of market structure is undertaken are concentration, barriers to entry, product differentiation, and the role of integrated firms within the given market.

The study of concentration has been undertaken to determine what effect, in terms of output, employment or sales, a given group of firms within the industry has on the actions of the whole industry. If one firm has over 90 per

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[2]Massel, M.S., Competition and Monopoly (Washington: Brookings, 1962), pp. 236-53.

cent of the productive capacity of the whole industry,[3] it is unreasonable to think that any of the small firms could enforce policies against the wishes of the large firm unless regulatory agencies were on the side of the small firms. The most prominent studies done on this topic were conducted by Bain in the United States[4] and Rosenbluth in Canada.[5] One classification system for measuring degree of concentration consists of determining what share of the industry output or employment can be accounted for by the largest four firms. Bain used industry sales, production or capacity, depending on the most relevant statistics (or data) available for the industry he studied.[6] Rosenbluth used employment figures for his study. The disadvantage of the latter system is the lack of proper deflators to take account of varying capital-labor ratios among the firms. For the petroleum industry, the most accessible statistics are those dealing with refining capacity. Accordingly, the degree of concentration at the

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[3]As Aluminum Company of America had in the United States in the 1940's and early 1950's.

[4]Bain, op. cit. He also published various articles on the subject. See his "Economies of Scale, Concentration and Conditions of Entry" American Economic Review, 1954, Vol. XLIV, pp. 15-39.

[5]Rosenbluth, G., Concentration in Canadian Manufacturing (Princeton, N.J.: Princeton Press, 1957).

[6]Bain, Industrial Organization, op. cit., pp. 125-32.

refining level is rather difficult to examine because of the large number of firms which have ties with the major integrated companies.[7] Financial ties could justify inclusion of producers under the parent or holding company, but contractual ties (especially exclusive supplying contracts) do not qualify inclusion with the buying refiner. Yet the producer is an integral part of the integrated firms operations.

The distribution of refining capacity in Alberta is examined in Table VIII. The corresponding study for Canada appears in Table IX. Some financial ties exist in the refining sector of the industry. By 1961, Shell Oil had already made offers to shareholders of Canadian Oil to buy all of the assets of that company. This was completed in 1963. Other refiners may have working agreements with refiners in other provinces. This is not to be confused with trading arrangements. The trading arrangements may suppress competition but does not exclude a refiner from a given market. The financial arrangement however, guarantes that one refiner will not compete with another refiner in a certain area for a specified time period.

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[7]The 1961 study of the crude oil industry by the Dominion Bureau of Statistics, The Crude Petroleum and Natural Gas Industry (Ottawa: Queen's Printer, 1963), lists 187 producing companies in Alberta and only 10 refiners.

existing level is rather difficult to measure because of the large number of firms which have been sold and merged into [illegible] companies.[?] [illegible] could [illegible] of production under the [illegible] company, but [illegible] [illegible] [illegible] [illegible].

The distribution of refining capacity in Alberta is examined in Table VIII. The corresponding [illegible] for Canada appears in Table IX. [illegible] of the industry. By 1961 [illegible] [illegible] of the [illegible] company, [illegible] in [illegible]. Other refiners [illegible] agreements with [illegible] in other provinces. [illegible] [illegible] [illegible] [illegible].

[?] The [illegible] by the Dominion Bureau of Statistics, The Crude Petroleum and Natural Gas Industry (Ottawa: Queen's Printer, [illegible]), lists [illegible] producing companies in Alberta [illegible].

TABLE VIII

PETROLEUM REFINING CAPACITY IN ALBERTA BY FIRMS FOR SELECTED YEARS 1951-1961[a]

Firm	Capacity in B/D			% of Alberta Total		
	1951	1956	1961	1951	1956	1961
Imperial Oil Ltd.	31,800	34,200	43,200	52.5	40.9	47.6
British American Oil Co. Ltd.	12,950	16,000	16,700	21.4	19.1	18.4
Texaco Canada Ltd.	5,500	12,000	12,000	9.1	14.4	13.2
Canadian Husky Oil Ltd.	5,000	7,900	5,170	8.3	9.4	5.7
Canadian Oil Co. Ltd. (now Shell)	. . .	. . .	4,500	. .	. .	5.0
Canadian Kodiak Refineries	1,500	4,000	3,500	2.4	4.8	3.9
Wainwright Producers Ltd.	300	4,000	3,500	0.5	4.8	3.9
Shell Oil Co. of Canada Ltd.	. . .	. . .	2,100	. .	. .	2.3
Others	3,500	5,500	. . .	5.8	6.6	. .
Total	60,550	83,600	90,670	100.0	100.0	100.0

% of Total Capacity Achieved by top four firms in	1951	91.3
	1956	83.8
	1961	84.9
by top eight firms in	1951	100.0
	1956	98.7
	1961	100.0

[a]Source: Dominion Bureau of Statistics, Petroleum Refineries (Ottawa: Queen's Printer, Annual).

TABLE IX

PETROLEUM REFINING CAPACITY IN CANADA BY FIRMS FOR SELECTED YEARS 1951-1961[a]

Firm	Capacity in B/D			% of Canadian Total		
	1951	1956	1961	1951	1956	1961
Imperial Oil Ltd.	202,050	289,000	338,700	49.1	40.5	35.2
British American Oil Co. Ltd.	71,650	102,500	148,600	17.4	14.4	15.5
Shell Oil Co. of Canada Ltd.	37,500	73,500	101,300	9.1	10.3	10.5
Texaco Canada Ltd.	50,500	70,000	71,000	12.3	9.8	7.4
Canadian Oil Co. Ltd. (now Shell)	3,700	30,000	49,500	0.9	4.2	5.1
Irving Refiners Ltd.	. . .	. . .	47,500	. .	. .	4.9
Canadian Petrofina Ltd.	. . .	20,000	28,000	. .	2.8	2.9
B.P. Refinery Canada Ltd.	. . .	. . .	26,000	. .	. .	2.7
Regent Refinery (Canada) Ltd.	. . .	14,000	26,000	. .	2.0	2.7
Consumers' Co-operative Ltd.	6,500	16,000	22,500	1.6	2.2	2.3
Others	39,350	97,750	102,660	9.6	13.8	10.8
	411,250	712,750	961,760	100.0	100.0	100.0

% of Total Capacity Achieved by top four firms in 1951 68.6
1956 75.0
1961 68.6

by top eight firms in 1951 95.4
1956 86.2
1961 84.2

[a]Source: Dominion Bureau of Statistics, Petroleum Refineries (Ottawa: Queen's Printer, Annual).

Using the concentration classes set out by Bain[8] whereby he considers an industry having more than 75 per cent of its output or capacity controlled by the top four firms as being highly concentrated, it can be concluded that the petroleum refining industry in Alberta fits this classification but the national industry at the present time would fit his type two classification (i.e. 50 - 75% of industry capacity accounted for by the top four firms). In the United States, the top refiners account for only 33 per cent of the industry output.[9] The explanation for this low figure can be derived from the historical influence of Standard Oil despite the dissolution of the original company. Eleven of the top twenty integrated firms in the United States are outgrowths of the old Standard Oil trust. There is still some doubt that former Standard Oil members compete as freely as they might. Only Standard Oil of New Jersey exhibits a clear leadership at the national level. The other former Standard Oil companies have continued to concentrate their efforts in the region to which they were assigned in 1911.

Comparison of the percentage of Canadian capacity accounted for by Imperial Oil Ltd. and the percentage of

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[8]Bain, Industrial Organization, op. cit., pp. 124-33.

[9]de Chazeau, M.G. and Kahn, A.E., Integration and Competition in the Petroleum Industry (New Haven: Yale Press, 1959), p. 17.

Canadian production by that company give almost identical results. Having 35.2 per cent of the total capacity, Imperial Oil consumed 36.0 per cent of the total crude oil consumed in Canada.[10] The preceding discussion of Imperial Oil's price leadership can be readily explained by its dominance of the industry capacity and output.

While a decade is undoubtedly a very short period from which to infer trends, it would appear that the dominance by the largest firm is declining. Imperial Oil has seen its share of the capacity and market decline from roughly one-half of the Canadian total in the early 1950's to one-third in one decade.[11] The explanation for this decline involves the pattern of ownership of the firms in the industry. Several notable newcomers have entered the refining phase, particularly in Eastern Canada. Three such examples are Irving Refining Ltd. in Saint John, New Brunswick; B.P. Refinery Canada Ltd., and Canadian Petrofina Ltd., both in Montreal East.

In the United States, the top twenty firms in the petroleum refining industry are considered "majors" of the industry. They account for 84 per cent of the total capa-

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[10] See Table A-VI, Appendix

[11] Ibid.

city, with the other 16 per cent being split up among 150 smaller refiners.[12] These majors are usually fully integrated and operate on an international scale. The degree of competition among these firms is usually very keen so that actions by one would precipitate retaliation by others. When Canada became a major crude oil producer in the 1950's, many of the companies established here were either subsidiaries of foreign companies or had some financial ties with foreigners. Few of the major American companies were willing to stand idly by while their competitors explored Canada. Because of this, many companies invaded a small market. Having decided to establish refineries, the companies began to seek out profitable locations. Unfortunately, there were few locations where an efficient size of plant could be erected. Some feel that very few areas have large enough markets to warrant even one optimum size refinery.[13] Several refineries exist in several small marketing areas, such as Northern Alberta. As the industry has begun to realize its mistakes, refinery closures have occurred quite steadily in the past decade. The latest to close was the former North

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[12] de Chazeau, op. cit.

[13] The President of Standard Oil in testimony, op. cit., felt that a 30,000 b/d capacity refinery was an absolute minimum for "efficient" production for refineries producing a large variety of petroleum products.

Star Refinery in Grande Prairie which was bought and subsequently closed by Shell Oil of Canada. Other closures in Alberta since 1956 occurred at Bonnyville where Bonnyville Oil Refineries Ltd. closed their refinery and at Hartell where Anglo American Exploration Ltd. formerly operated a refinery. However, one new refinery opened in that period. That was the refinery at Innisfail built by Canadian Oil Company and subsequently taken over by Shell Oil of Canada.

All of the refinery closures have been what may be termed the smaller refineries so that the larger companies were able to gain a substantial segment of the Canadian market. Many of the American giants, such as some of the former Standard Oil affiliates have decided to forego the Canadian market altogether. Others, such as Standard of California operate only at the marketing stage. Still others, such as Socony-Mobil are more involved in production. By spreading their interests among the various stages of the petroleum industry, the American majors are able to influence the Canadian development without incurring substantial losses from saturation of a market by too many refining plants operating at outputs which are far below the optimum output for that scale of plant and/or the minimum cost position on the long run average cost curve.

From the efficiency stand-point it is not unreason-

able to expect a high degree of concentration in the Canadian economy. However for concentration to be high, it is probable that there is a certain tacit understanding. Not all American firms can operate profitable subsidiaries in Canada. In some industries the shape of the long run cost curve is such that costs do not rise appreciably even if the size of plant is considerably less than optimum size. A long run cost curve which has a wide and gently sloping bottom (see figure 10A) could allow a firm to build plants which are

LONG RUN AVERAGE COST CURVES WITH VARYING SHORT RUN PLANT POSSIBILITIES

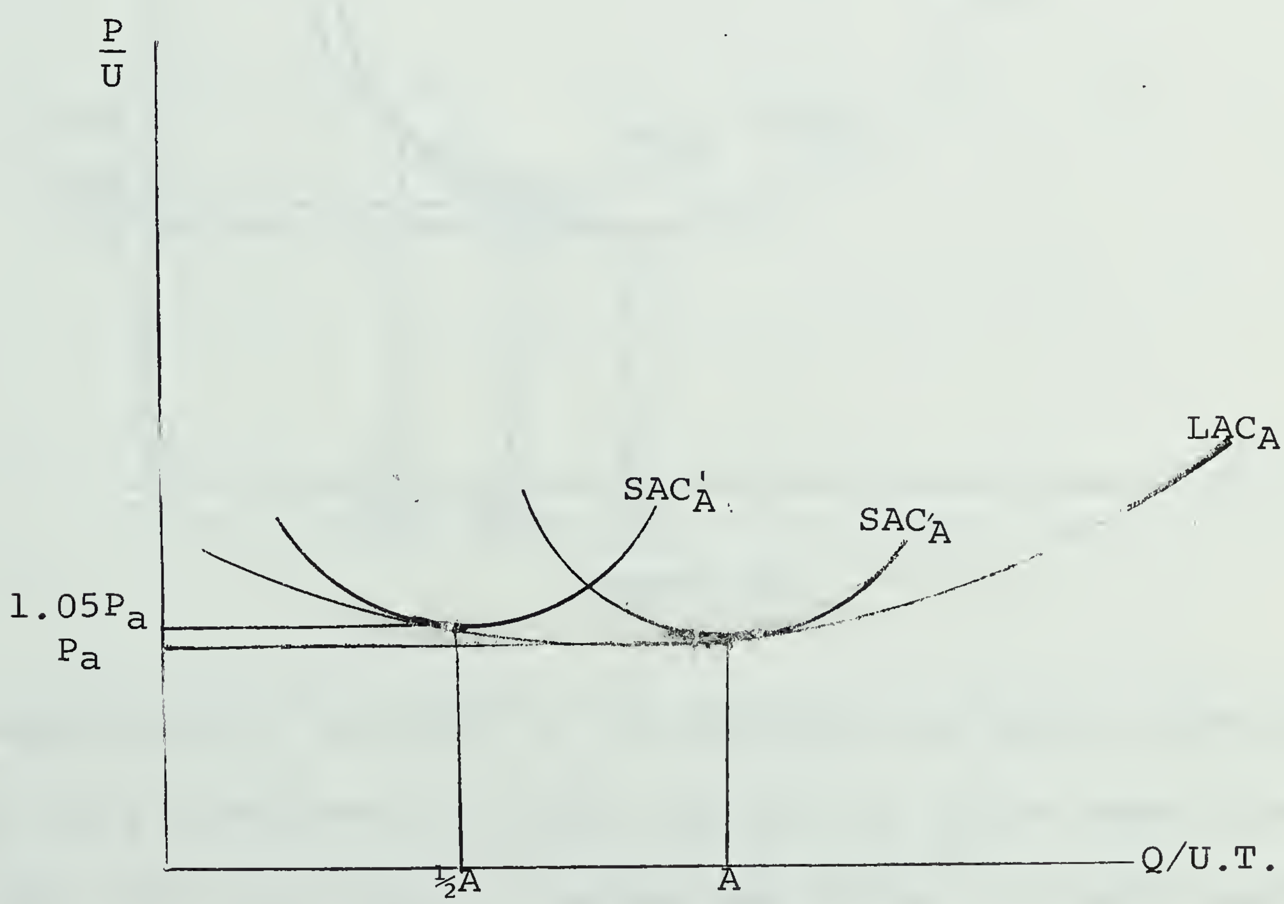

FIGURE 10A

not of long run optimum size and yet this firm's costs would

not rise appreciably if each of these plants were operated at its most efficient output. Long run cost curves which have steep sides and a narrow flat range (see figure 10B) could hardly warrant a firm building plants other than optimum scale unless prices were high enough to support operation of these inefficient plants. Building a plant of

LONG RUN AVERAGE COST CURVES WITH VARYING SHORT RUN PLANT POSSIBILITIES

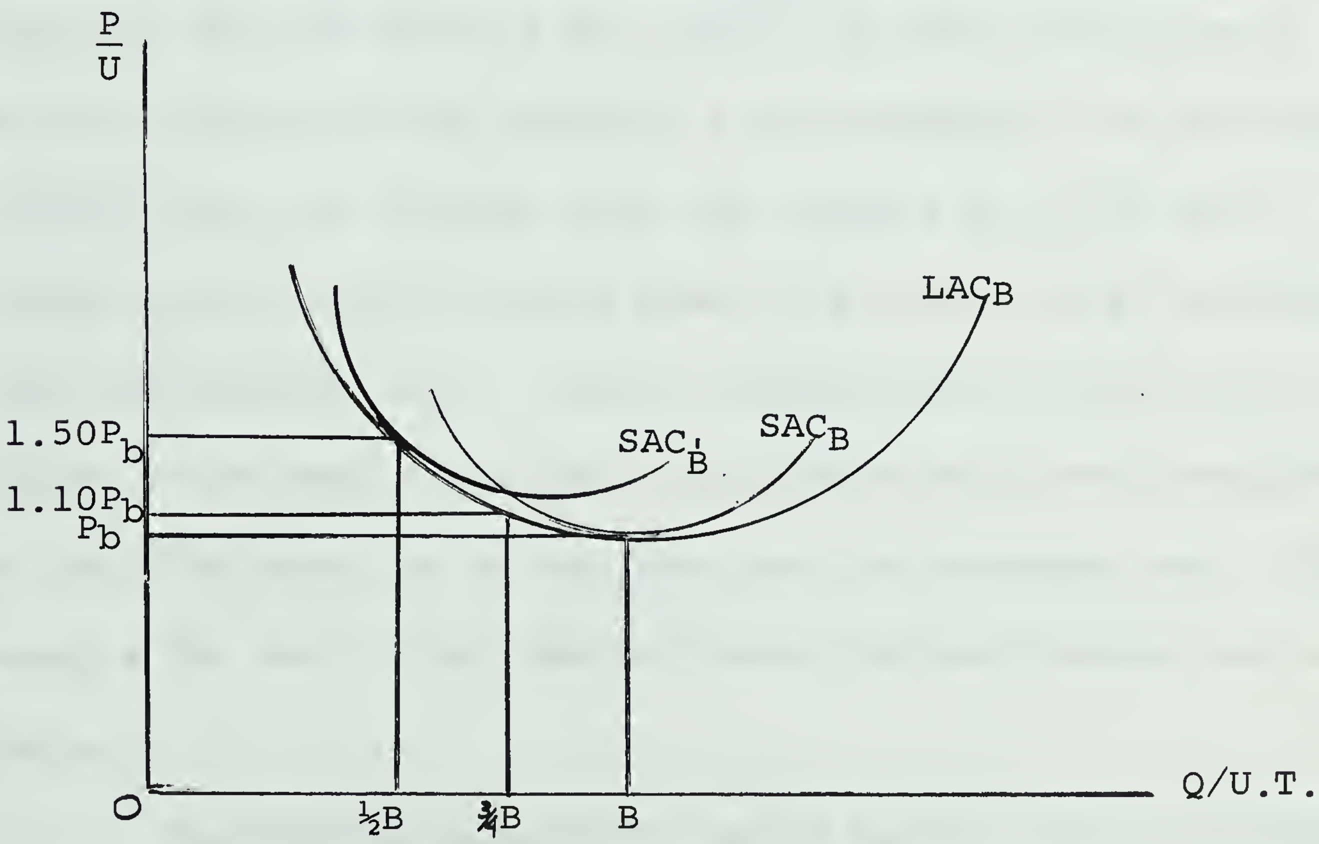

FIGURE 10B

approximately one-half of the optimum size would raise costs by only 5 per cent in Figure 10A but by 50 per cent in Figure 10B. If a firm had to operate two plants, it could decide to build both of them to operate at less than optimum efficiency, depending on the shape of the long run cost curve. From the

shape of the long run cost curve in Figure 10B, it appears that operation of two plants at 75 per cent of optimum scale lowers costs to $1.10P_b$, thereby being more efficient than one long run optimum size plant and one at half optimum.

Studies of the long run cost curves for twenty industries have been reported by Bain.[14] He finds the petroleum industry has a relatively flat long run cost curve from capacities of 30,000 barrels per day to capacities as large as 360,000 barrels per day.[15] A plant which has a 30,000 barrel per day capacity i.e. one-quarter of optimal minimum long run average cost can operate at 4 per cent higher cost than an optimum size firm operating at minimum long run average cost. Cement manufacturers face 30 per cent higher costs when operating with plants which are one-quarter of the size possible at minimum long run average cost. The results for six United States industries are summarized in Table 10.

The petroleum industry could support only 57 plants of long run optimum size in 1951. Since the Canadian economy was approximately one-twelfth the size of the United

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[14] Bain, Economies of Scale, op. cit., pp. 54-56. The absolute values of the various capacities are based on estimates. See Chapter II. Supra.

[15] Ibid.

States economy, the results would suggest that about 5 optimal size plants could have been sufficient to supply

TABLE X

ESTIMATES OF OPTIMUM SCALE PLANTS IN VARIOUS INDUSTRIES IN THE UNITED STATES CIRCA 1951[a]

Industry	% of U.S. Output in one Optimum Size Plant	No. of Optimum Size Plants Needed to Supply U.S. Output	Cost Rise for Other Size Plants		
			½ Opt.	¼ Opt.	2 Opt.
Petroleum Refining	1.75	57	2%	4%	0%
Shoes	0.14	700	n.a.	n.a.	n.a.
Typewriters	10-30	3-10	n.a.	n.a.	n.a.
Liquor (Distilling)	1.25-1.75	57-80	1%	2%	0%
Rayon	4-6	16-25	7%	25%	n.a.
Cement	0.80-1.00	100-125	15%	30%	0%

[a]Source: Bain, Economies...op. cit.

the Canadian market.[16] Using actual statistics at the present time, the industry output could be supplied by eight refineries.[17] Instead, forty-three refineries operate. The

[16]Bain's study was based on 1951 data. The refinery runs in Canada at that time were about 360,000 barrels per day suggesting that only 3 refineries operating at 100% of optimum long run capacity would have been necessary.

[17]The 1963 refinery throughput was 908 thousand barrels per day. If 120,000 barrels per day capacity achieved lowest unit costs, 8 to 9 refineries operating near capacity would have been needed.

ratio of actual refineries in operation to the minimum needed is about eight to one. This is somewhat higher than the six to one ratio in the United States.[18] Only twelve of these Canadian refineries are larger than 30,000 barrels per day capacity and only one, the Imperial Refinery at Sarnia (94,000 barrels per day capacity) is likely to be approaching a minimum cost position.

The comparison of the Canadian and U.S. economies is not as simple as some figures would indicate. Differences in population, market density and per capita income must be introduced. The main markets in Canada are located in areas surrounding the major cities. With the exception of Edmonton, these cities are located less than 100 miles from the international boundary. The distances between Western Canadian cities are great and transportation costs can far outweigh economies of scale. These costs may run as high as 3.0 cents per gallon per one hundred miles. Therefore, it is unrealistic to assume that Canadian refiners can operate the large plants which are now being used in the United States. Western Canadian refiners in particular have found that operation of small scale plants is more economical than hauling gasoline in trucks for distances which may exceed 300 miles.

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[18]Cassady, op. cit., p. 34-35.

Since this country will probably continue to be relatively sparsely populated, the need for having local refiners to supply the areas surrounding the refineries will continue. If some duplication of facilities could be eliminated, the economies of scale to be gained by one plant operating instead of several might help to decrease the costs of production and consequently lower the price to the ultimate consumer.

The figures in Table X would suggest that larger than optimum plants would not increase long run costs. Firms have not been anxious to build these large plants, fearing the cost curve will turn upwards in this range. Therefore, cost results for plants which are twice the optimum size are often based on estimates made. Most firms would rather build a second smaller plant and hope market conditions will allow additional facilities to be added in the future so that a second optimum size plant will eventually be reached.

An optimum size firm can mean many things. Just because a firm has achieved optimum size in terms of aggregate output does not mean that all of its components are optimum size.[19] It is true that a cost curve takes account of all

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[19]Robinson, E.A.G., The Structure of Competitive Industry (Chicago: University of Chicago Press, 1958),

variable and fixed components. What it does not take care of is the changes which constantly occur in the economy. Technology, management, finance and marketing are constantly varying the cost curves. Therefore, a long run cost curve is not a fully meaningful concept because it is continually shifting.

There is a distinct difference between operating a plant at its optimum output and operating an optimum size plant in the long run. There are many possible plants which can be operated at their optimum output in the short run but which are not optimum plants in the long run. Economies associated with operation of a given plant exist in many industries. These are short run phenomena which determine the best operating position of a plant in the short run. However, they do not influence long run decisions which determine what scale of plant will be constructed. In the short run, given the same size plants for two firms having different market shares, the firm having the larger share of the market is going to be able to produce goods at a lower cost than a smaller firm which cannot take advantage of cost savings due to these economies. Existing technology may dictate the size of plant which is most economical to construct but all firms

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Chapter 2-5.

may not be able to operate this plant at its optimum position. The firm which has the largest share of the market will be able to maximize its profits at larger output than the smaller firm. Not only will its costs be lower, but given the downward sloping demand curve, its selling price may be lower as well because its share of the total market demand will allow profit maximization at higher outputs.[20] Therefore the consumer benefits from a firm operating a plant which has economies of scale. Wherever economies of scale are significant the degree of concentration may be high because the consumer is unwilling to pay a high price which would result from a firm trying to maximize its profits while having only a small share of the market. The extreme example of having many small firms operating where economies of scale are significant would be in the power utility industry where operation of several small plants may mean that the price charged to the consumer is many times that which would be charged if only one plant was operating.

If a market can support only a few firms of optimum size, firms wishing to enter must consider the possibility that one or more firms will be forced to alter their intensity

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[20] Given identical plant sizes, the shape of the marginal cost curve will determine profit maximizing prices. Where the marginal cost is increasing, the larger firm will want to charge higher prices than the smaller firm if profit maximization is the firm's goal.

of plant use in the short run and scale of plant in the long run. If they do enter, costs may rise for few or all firms, depending on the new allocation of the factors of production. A new allocation of the market may alter the profit maximizing output of some of the firms in the industry. If each firm receives a smaller share of the market, it will contract its output to maximize profits at a new level. The consequences of these actions would be higher prices to the consumer if the price setting firm(s) was forced to reduce output because the demand curve facing it shifted. New firms may not wish to enter a market where prospects for producing at existing product prices would not be possible after the entry. The prospect of facing a lower absolute share of total output because prices would supposedly rise may be a deterrent to entry of new firms. However other barriers may exist. These are product differentiation, absolute cost advantages existing for some firms and capital requirements.

Product differentiation may exist in the physical sense or simply in the minds of the buyers. To attract buyers, firms must create a favorable image with their products. Products may be differentiated on the basis of physical qualities, brand names or services offered with the products i.e. non-price inducements.

A product may be perfectly homogeneous in the

physical and technical sense, but in the eyes of the consumer some differences exist. These differences are explainable by the image created by the firm's advertising campaign or non-price inducements. Gasoline is relatively homogeneous from the production standpoint. Some additives may distinguish one product from another but most refiners will agree that the performance differences between the various brands of gasoline are not very great. Advertising campaigns are not designed to simply create a brand preference but also to convince the consumer that services rendered by a given company are superior to those rendered by competitors. Non-price competition has been employed with success. Services rendered by the service station attendant such as checking the oil, tires, battery, etc. do much to sell the image of the company.

Credit cards and privileges extended to credit card users give companies assured patrons. However, to keep these customers happy a company must rely on favorable location and service.[21]

Bain has found that product differentiation is perhaps surprisingly high in the sale of petroleum products

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[21]Especially important lately have been sales of goods other than automotive goods such as lawn equipment, barbecues, cameras and toys at the service station. These can be readily charged on oil company credit cards.

despite the relative homogeneity which exists among the products identified by various brand names.[22] A high degree of brand preference also exists for relatively homogeneous goods such as cigarettes and liquor but little or no brand loyalty exists for steel, rayon and meat. The main reason for Bain's conclusion of the high degree of brand preference for petroleum products can be traced to the location of service stations.

Industries which rely heavily on patented production techniques or specialized sources of raw materials may have absolute cost advantages over firms trying to enter an industry. Strategic location of raw materials and long term contracts traditionally favored the steel companies operating in the Pittsburgh area. Patented processes for manufacturing nylon helped DuPont to rise to a dominant position in the synthetic fibres industry. In petroleum refining, however, absolute cost advantages have not been important in forestalling entry of potential competitors. Most of the production techniques are quite similar for many companies and few patented processes of vital importance exist. Most raw material sources, especially in Alberta, are not being utilized at full capacity. A potential entrant to the in-

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[22] Bain, Barriers to New Competition (Cambridge: Harvard University Press, 1962), pp. 127-143.

dustry could find a ready supply of crude oil to meet his needs.

Another barrier to entry which can sometimes have important implications for a potential entrant is capital requirements. To build a refinery, a company must be prepared to invest a large sum of money. Various estimates have been made for necessary capital expenditures. Actual expenditures on plant and equipment for a refinery would average anywhere from $1,000 to $10,000 per barrel per day capacity, depending on the facilities needed. A refiner may have to construct not only the refinery proper but also production, transportation and marketing facilities. Hanson estimates that refinery costs in Alberta, given the size of refineries now being constructed here, are about $1,000 to $1,200 per barrel day capacity. Total expenses needed to set up production, transportation and distribution facilities can push this cost as high as $10,000 per barrel day refinery capacity.[23] A refiner who wants to set up a refinery complete with all stages of production needed for producing the final good can figure on capital expenditures of $10,000,000 for a relatively tiny 1,000 barrel per day refinery and $300,000,000 for a minimum efficient size refinery. Over

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[23]Hanson, op. cit., p. 148.

$1,000,000,000 may be needed to finance a refinery of optimum size.[24] Such figures can indeed be discouraging for entrants who propose to enter an industry where some excess capacity traditionally exists.[25] Undoubtedly, the giant corporations would be willing to invest such sums in areas where refining capacity is not large enough at present.

In Canada, most of the investment in refineries has been of the piece-meal kind. Refiners have chosen to expand capacity with the growth of the market because refining capacity can be increased in this manner. Little duplication of facilities is actually necessary when expansion is undertaken because capacity for skimming (i.e. for distillation of straight run gasoline) or cracking can be increased by adding more fractionating towers. These are available in many sizes to meet varying specifications. Refiners have resorted to piece-meal planning to build plants to meet present market conditions with the provision that new pieces can be added without a major reallocation of existing equipment. Capital requirements are thus eased somewhat because they can be spread over a considerable time period.

The various barriers to entry, whether economies of

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[24] Only steel and automobile plants require more capital investment for one optimum size plant.

[25] See Table A-VII, Appendix

scale, product differentiation, absolute cost advantages, transportation costs or capital requirements can allow existing firms to price their products higher than average costs without attracting potential competitors. Some barriers to entry exist for refinery trying to enter the Alberta industry. However, just which of the barriers are most important is not always clear. Potential competitors will not likely capture a considerable share of the market unless they replace existing firms. The addition of new firms can only drive up costs for all the firms in the industry because the total market is too small to allow efficient production in many plants. It is not necessary for the cost curves to shift upwards although this may be the case. The alternative is for each plant to operate at less than optimum capacity thereby increasing unit costs of operation. In recent months, several firms have indicated their intention or willingness to enter the Alberta refining industry.[26] The barriers to entry would not appear to have much influence in forestalling competitors.

It was found that United States refiners could raise prices up to 7 per cent above minimum average costs without

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[26]Shell Oil Canada Ltd. and Sun Oil Canada Ltd. have both been mentioned in rumors that a new refinery for Edmonton is being considered. See Financial Post, April 10, 1965, p. 62.

attracting competitors. In some other industries, notably automobiles and cigarettes, prices could be raised more than 10% above minimum costs without fear of potential entrants.[27] Alberta refiners have costs at least 7 per cent greater than the minimum average costs, if the shape of the cost curves is such that costs rise appreciably for outputs less than 30,000 barrels per day.[28] It is not altogether clear whether the entry of new refiners in Alberta in the last decade has been due to high prices or to a rapidly expanding market. Supposedly the prospect of profits has existed so that new firms have been able to overcome any barriers which the Alberta firms have set up.

A trading arrangement could be properly classified as a barrier to entry. Whether it is an effective barrier cannot be readily ascertained, but appears unlikely. Since most of the newcomers in Alberta are well established firms in other market areas, one can assume that trading arrangements would not be an effective barrier because the potential entrant could retaliate by refusing to offer attractive arrangements to some of the Alberta firms operating in other areas where their superiority does not exist.

Another important facet of market structure is the

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[27]Bain, Barriers...op. cit., p. 169.

[28]See Table X, Supra, p. 71.

role of integrated firms. These may be of two types, the horizontally and the vertically integrated. All of the major petroleum companies are vertically integrated if vertical integration is defined as operation in two or more stages of the production process. Many of these firms are also horizontally or geographically integrated. While these latter terms are not necessarily synonymous, both are often associated with a firm concentrating its efforts in a given market. If integration is combined with intercorporate financial control, the result may be a very high level of concentration in a market. The most serious case of this in the petroleum industry occurred in the early 1900's when the Standard Oil trust, through mergers and expansion into many phases and areas of production, was able to control 85 per cent of all refining facilities, 90 per cent of all transportation and 85 per cent of all marketing in the United States by the time its dissolution was ordered in 1911.[29] The resulting split created 33 new companies each of which was given a market area so that some semblance of competition could be restored. However most of these have now become fully integrated again and 11 of the former Standard firms are among the top 20 petroleum firms in terms of sales in the

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[29]Alderfer, op. cit., p. 276.

United States. What important advantages are there which drive these firms towards integration?

Each of the functions of integrated firms could conceivably be performed by smaller firms each operating in an area and performing a function. However, managerial economies are often lacking in these organizations. Top management working as a large team is able to lower managerial costs per unit of output. It is believed by some theorists that a limit is reached, beyond which diseconomies set in. This limit does not necessarily correspond to minimum long run average cost. The cost of management per unit of output varies widely depending on degree of integration and centralization of facilities. One important advantage of management in a large and integrated firm is the ability to attract specialists in many fields.[30] The petroleum industry has decentralized management so that each management unit is near the source of its dealings. Producing, marketing and accounting divisions are set up on regional bases in Canada.

Because of diversification made possible by integration, the large firms are usually on a less risky financial basis than firms that have "put all of their eggs in one basket." Financing of new projects by borrowing will be

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[30] Robinson, E.A.G., op. cit., Chapter 3.

cheaper for a firm which has a broad range of interests and hence is not nearly as likely to declare bankruptcy or suffer catastrophic set-backs if market conditions for one of its products become unfavorable. Because capital investments are very great in both producing and refining stages, financial resources must be readily available when requirements warrant. Only a large and well-established firm is able to meet these commitments on short notice. Too often discoveries of oil are sudden and development of an oil field must be undertaken rapidly to dissuade competitors from taking advantage of the firm which has made the initial find. The producer must be able to have equipment and finances ready when such emergencies arise.

Integrated firms are in the best position to distribute men, equipment and money to areas or phases of production which require these factors. If these firms possess a degree of market control, they may be able to price their products in such a way that the small competitor at the various stages is forced out of the market. By concentrating their efforts, they can have whole stages of production acting as loss leaders for other stages or a whole marketing area acting as loss leaders for other marketing areas. This becomes the familiar concept of price discrimination among markets or in some cases, among classes of buyers in a given

market.

In Alberta, the integrated firms have been accused of trying to hold the ratio of MPR to MER as high as possible by deliberately curtailing exploratory activities.[31] To forestall potential entry, the integrated firms have bought the mineral rights from the provincial government and then deferred exploration of these lands. At the same time, most of the potential land is not available to others. The independent non-integrated firm would be unable to use this technique because it would have no source of income (except from borrowing or share issue) to offset the necessary expenditures.

The integrated firms have usually regarded the production stage of the industry in Alberta as being necessary but rather unprofitable. The prorationing schemes in Alberta have been responsible for holding profits low. As a result, integrated firms have "farmed out" their leases to small independent drilling and producing companies who then explore and if successful, develop the oil fields. They sell their crude oil to the refiners. At this point the profitable venture really begins. While many producing companies have shown sizable profits, the rate of return on investment has

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[31] Edmonton Journal, February 26, 1964, p. 61.

been higher in refining, pipelines and marketing.[32] These latter stages are all highly concentrated and a degree of control over the market output exists. The producers must sell their outputs at the posted field prices and even then must meet quotas so that short run profits are not necessarily available if quotas are not sufficient to cover costs of production. Once a well is designated as a producer, most of the costs have already been incurred. Operating costs are relatively minor compared to the fixed costs of exploring and developing the well site. Since most of the costs have already been incurred, producers are more than anxious to sell products in the hope of recovering some of their investment.

The American petroleum industry has been dominated by the integrated firms. The percentage of output by these firms has varied in the various production stages from 58 per cent in retailing to 60 per cent in production, 83 per cent in crude transportation and 96 per cent in refining.[33] In comparison, the Alberta refining industry is 100 per cent controlled by integrated firms and the crude transportation stage nearly so. The retailing stage is only 42 per cent

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[32]Marketing here refers to distribution only to the retailer and not to the final consumer. The degree of concentration at the wholesale distribution level is still high.

[33]de Chazeau, op. cit., p. 23.

company controlled, if independent dealers holding exclusive contracts are not considered as being company controlled.

The "price squeeze" possible when control of an industry is allowed to fall into the hands of a few integrated firms can be harmful to the economy. If refiners refuse to buy crude from producers at prices which will insure profits for the producing stage, there is little the producers can do if alternatives are open to the refining company in the form of other sources of supply. Regulated prices through output restriction have effectively precluded this arrangement in Alberta. Most refiners in Alberta have interests in the producing phase so that they are not anxious to jeopardize the production stage by unruly tactics at the refining stage.

At the present time, the structure of the crude oil market is rather rigid. There is little which can be done to insure more output of crude oil, which could conceivably drive down prices, until new markets are found. With the Oil and Gas Conservation Board acting as a selling agency and a few oligopsonistic buyers taking most of the crude oil, powerful influences exist on both sides of the market. As Galbraith described it, contervailing power has taken over the market.[34]

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[34]Galbraith, J.K., <u>American Capitalism: The Concept</u>

The product market is supplied by a few oligopolists although retail outlets could be classified as being monopolistic competitors. Some choice exists for the buyer but this choice is created by advertising and non-price inducements rather than large price or technological differences. Some price differences exist between the branded and the unbranded gasolines but the choice among branded or unbranded gasolines cannot be made on the basis of price differentials. A buyer can refrain from substituting other goods for gasoline if these exist. Except for marginal uses there are few economically feasible substitutes for gasoline as a source of fuel in automobiles.

Whether harm to the economy due to misallocation of resources is great is a matter of controversy. No doubt some harm is done but on the other hand, market sharing appears to be necessary in an industry where outlays are huge and ultimate recovery of these outlays involves long periods of time. Since our economy is not perfectly competitive, just what basis should we use for a guide to determine the best available allocation of resources? In order to analyze the performance of an industry some basis is needed. Economists have devised many theories to try to answer problems

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<u>of Contervailing Power</u> (Boston: Houghton Mifflin, 1952).

which our economy has posed. Examination of some of these theories may help in understanding the need for introducing theories to explain performance which can be observed. Observation in turn helps in evaluating and criticizing an industry for failure to meet the norms which have been set out for it.

CHAPTER IV

PRICING OF PETROLEUM PRODUCTS--A REVIEW OF PRICE THEORY

The study of an industry is best undertaken when one has some knowledge of theoretical tools. These tools can then be applied to fit the cases to be considered. Economics is a field which has many theories developed to help those familiar with them to explain phenomena in the real world. The study of the petroleum industry requires some knowledge of not only price theories but also distribution theories, wage theories and many others. For the purposes of this paper, only the microeconomic aspects will be dealt with in detail. In many cases, other theories are implicitly assumed. However the macroeconomic theories, fiscal theories and other theories are not explicitly stated even though some inferences are drawn from time to time. The specific cases to be dealt with are the common versions of theories of the firm dealing primarily with price and output solutions. The initial development will utilize only one product output. The more complicated cases where multiple products can be introduced will constitute the remainder of

the chapter.

The petroleum industry, like most industries in our economy, is not perfectly competitive. Neither do monopolists exist, except in few limiting cases. While a true monopolist is difficult to find in Alberta, the refining stage of the industry in the North West Territories is completely supplied filled by one refiner.[1] Imperial Oil Limited operates the lone refinery in this market at Norman Wells. To understand the principles of pricing by a monopolist, some basic monopoly theory is needed. Suppose that this monopolist could produce only one product from his factor inputs. He would want to know how much of the product to produce and what price to charge for each unit. His output and price may depend on a variety of goals.

Most economists assume that the primary goal of most firms is maximization of profits. To maximize profits, the marginal cost of producing an additional unit of output is weighed against the marginal revenue to be gained by selling this additional unit. The output where equality of marginal cost and marginal revenue exists will yield maximum profits for the firm.

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[1]In some cases, specialized products may be produced by one refiner only. Some grades of asphalt are produced for the whole Alberta market at the Lloydminster refinery only.

It is possible that a firm cannot maximize profits. Perhaps the market is not sufficiently developed and a regulatory agency feels that prices which are lower than those desired by a firm are desirable for welfare purposes. This agency may then impose a maximum price or alternatively, try to encourage a higher output to be produced.

The firm itself may have goals which are not necessarily compatible with profit maximization. For example, a firm may want freedom from political interference or antitrust probings and may want to establish itself as an integral and respected segment of the community.[2] Definitions of profit maximization can vary, depending on the time period to be considered. Long run profit maximization goals may prevent a firm from maximizing profits in the short run. It may deliberately charge less for its products than it would were short run profits the goal. Thereby, the firm could establish a larger volume and possibly create additional demand over the long run when its cost curves would shift as more efficient plants are built.

In practice, neither marginal costs nor marginal revenues are readily ascertained. Trial and error methods are used by firms to determine desirable outputs. Because

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[2]For further details see Massel, M.S., Competition and Monopoly (Washington: Brookings, 1962), Chapter 2.

our economy is dynamic, the trial and error method never yields the desirable solution. Rather, a solution which is constantly being altered by various forces is attained. Just as a firm is reaching a solution which it hopes will maximize profits, a new chain reaction may be set off and another set of forces may alter the demand function, the production function or both.

Monopoly theory has become the idealized form of imperfect competition. It is much simpler to define than other forms of imperfect competition because most of the concepts are more readily isolated. For example, the demand curve facing an industry is the demand curve facing the monopolist. By definition, the monopolist constitutes the industry. He produces one product[3] for which there is no close substitute. For purposes of exposition, it will be assumed that all factors are bought in perfectly competitive factor markets.[4] The realism of this assumption in the petroleum industry needs few simplifying statements because the crude oil industry or the production stage of the whole

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[3]The initial development of the theory assumes any firm can only produce one product. The multiproduct cases are left for future discussion.

[4]Monopsonistic power actually exists but we will assume that any unit of input is bought for the same price as any other unit.

petroleum industry is nearly perfectly competitive from the sellers' standpoint if each oil well constitutes one firm.

A monopolist will only produce if he can cover his variable costs in the short run and his total costs in the long run. But, a monopolist may want to make profits in excess of "normal" profits.[5] It may be able to do so by one of two methods. If the demand curve exceeds the average cost at the profit maximizing price, the monopolist will have excess profits at his disposal.[6] Even if the demand curve does not exceed the average cost curve at this output, the monopolist may be able to earn excess profits by practising price discrimination. To do this, he would have to be able to subdivide his market into submarkets, each of which has a different elasticity of demand. To maximize profits, the monopolist would then sell that output in each submarket which would bring him the same marginal revenue as that brought by the output sold in any other submarket. The general case of a monopoly price and output solution can be depicted in

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[5]Normal profits are defined to be those profits which are just sufficient to give an entrepreneur incentive to stay in the industry in the long run. In other words, a normal rate of return is equal to an entrepreneur's opportunity cost.

[6]Assuming that regulatory agencies allow this price to be achieved and taxing authorities do not impose lump sum or excess profits taxes on the monopolist which would tax away all of these excess profits.

figure 1. While a monopolist desires to produce output OA and charge OB per unit, he could be persuaded by regulation

PRICE AND OUTPUT DETERMINATION FOR A MONOPOLIST PRODUCING ONE PRODUCT

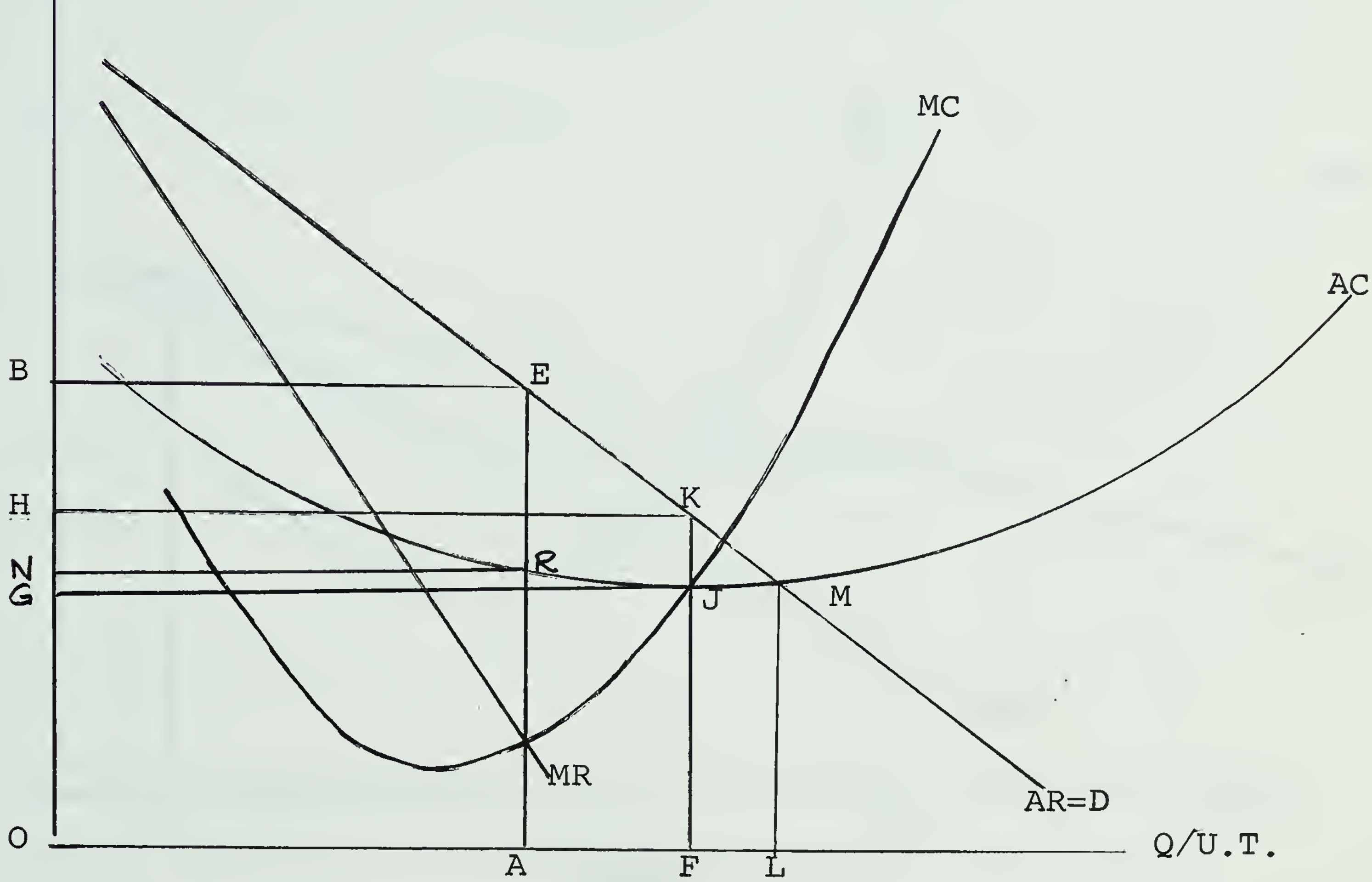

FIGURE 1

to expand output. However, the monopolist could still earn excess profits for outputs less than OL. If the price is regulated (e.g. the pegged price is OH), maximum output is predetermined although the monopolist may not produce that output. If the output is regulated at OF the monopolist can still earn excess profits of GJKH because the price charged exceeds marginal revenue and marginal cost even

though average cost is at a minimum.

PRICE AND OUTPUT DETERMINATION FOR A PERFECTLY DISCRIMINATING MONOPOLIST

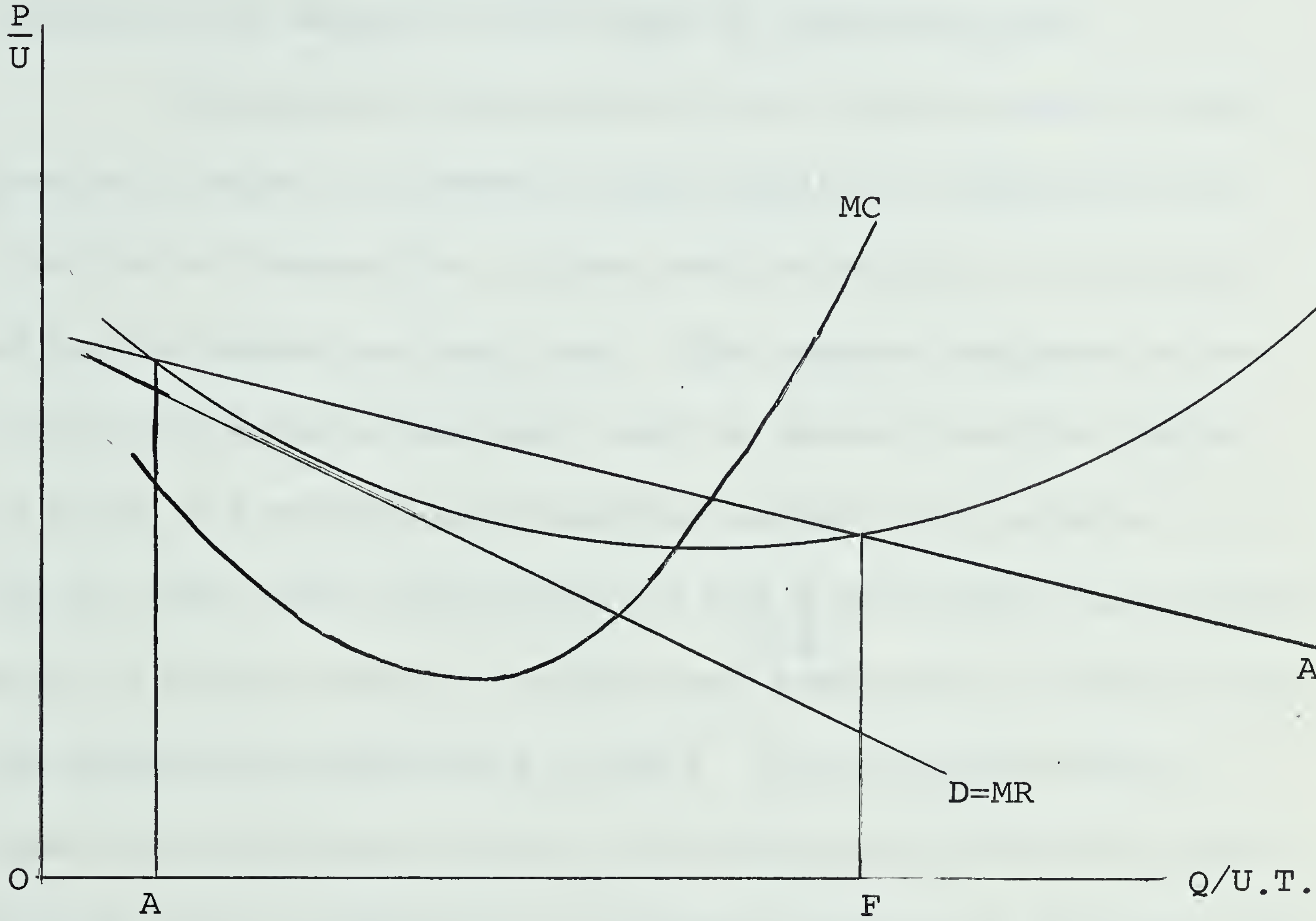

FIGURE 2

If price discrimination is allowed, the monopolist may be quite willing to sell the marginal unit at less than average cost. The situation can be depicted in figure 2. While the demand curve is now below the average cost curve at all outputs, the average revenue curve is above the cost curve, thereby allowing the monopolist to gain excess profits in the output range from OA to OF. The marginal revenue curve will be identical to the demand curve if perfect

discrimination can be practised.[7] For the more common cases where some discrimination exists, the average revenue curve will not coincide with the demand curve. The divergence will depend on the type of discrimination.

The general principle of price discrimination among groups of buyers is based on the ability to separate elasticities of demand for a given good according to the group of buyers demanding that good. The Ameroso-Robinson price-elasticity formula has been used to demonstrate the method of price and output determination between two markets.[8] It can be shown that the identity $P = \frac{MR}{1-\frac{1}{e}}$ describes the relationship of price, marginal revenue and elasticity. Denoting the two markets by subscripts 1 and 2, it can be seen that equality of marginal revenue would mean that the price ratio between the two markets is inversely related to the ratio of the elasticities. Therefore, the higher price must exist in the less elastic submarket.[9]

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[7]Perfect discrimination can be defined as the price structure existing if each unit of output is sold for the amount the buyers are willing to pay for that additional unit. In practice, some type of block (i.e. several unit) discrimination often exists. The marginal revenue curve is then jagged, changing direction with each price change.

[8]Schneider, E., Pricing and Equilibrium: (London, Allen and Unwin, 1962), p. 73.

[9]Leftwich, R.H., The Price System and Resource Allocation (New York: Holt, Rinehart and Winston, 1961),

In order to separate the two submarkets, some barriers between them must exist. These barriers may be geographical, economic, psychological or legal in nature and cannot be overcome by middlemen willing to engage in speculative trading to equalize prices. It is obvious from the relationship that equal prices in the two sub-markets will yield no gains to the discriminating monopolist which could not be achieved by denoting the two markets as one.

A further possibility for a monopolist trying to exploit a market exists. He may decide to produce the product for the two submarkets from two plants. His profit maximizing output would be determined from aggregate marginal revenues from the two submarkets. Subdivision of output between the plants would be done on the basis of equating marginal costs for both plants. Geometrically, the solution of figure 3 can be applied. The appropriate output in market 1 is OA and in market 2 is OB. If these markets have different elasticities of demand and are separable, prices OP and OR

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pp. 231-32. From the identity $P = \frac{MR}{1-\frac{1}{\varepsilon}}$, it is seen that MR= $P\ (1-\frac{1}{\varepsilon})$ so that the two submarkets yielding equal marginal revenues would yield the identity $P_1\ (1-\frac{1}{\varepsilon_1}) = P_2\ (1-\frac{1}{\varepsilon_2})$. If price is higher in the first submarket, elasticity must be greater in the second submarket if a balanced equation is to be retained. Since $P_1/P_2 > 1$, $1-\frac{1}{\varepsilon_2}/1-\frac{1}{\varepsilon_1} > 1$ as well so that $\varepsilon_2 > \varepsilon_1$.

would exist in markets 1 and 2 respectively. Output OA plus output OB equals ST, the profit maximizing output for both markets using both plants.

While many of the basic principles affecting a

PRICES AND OUTPUTS EXISTING IN SUBMARKETS SUPPLIED BY A MULTIPLANT MONOPLIST

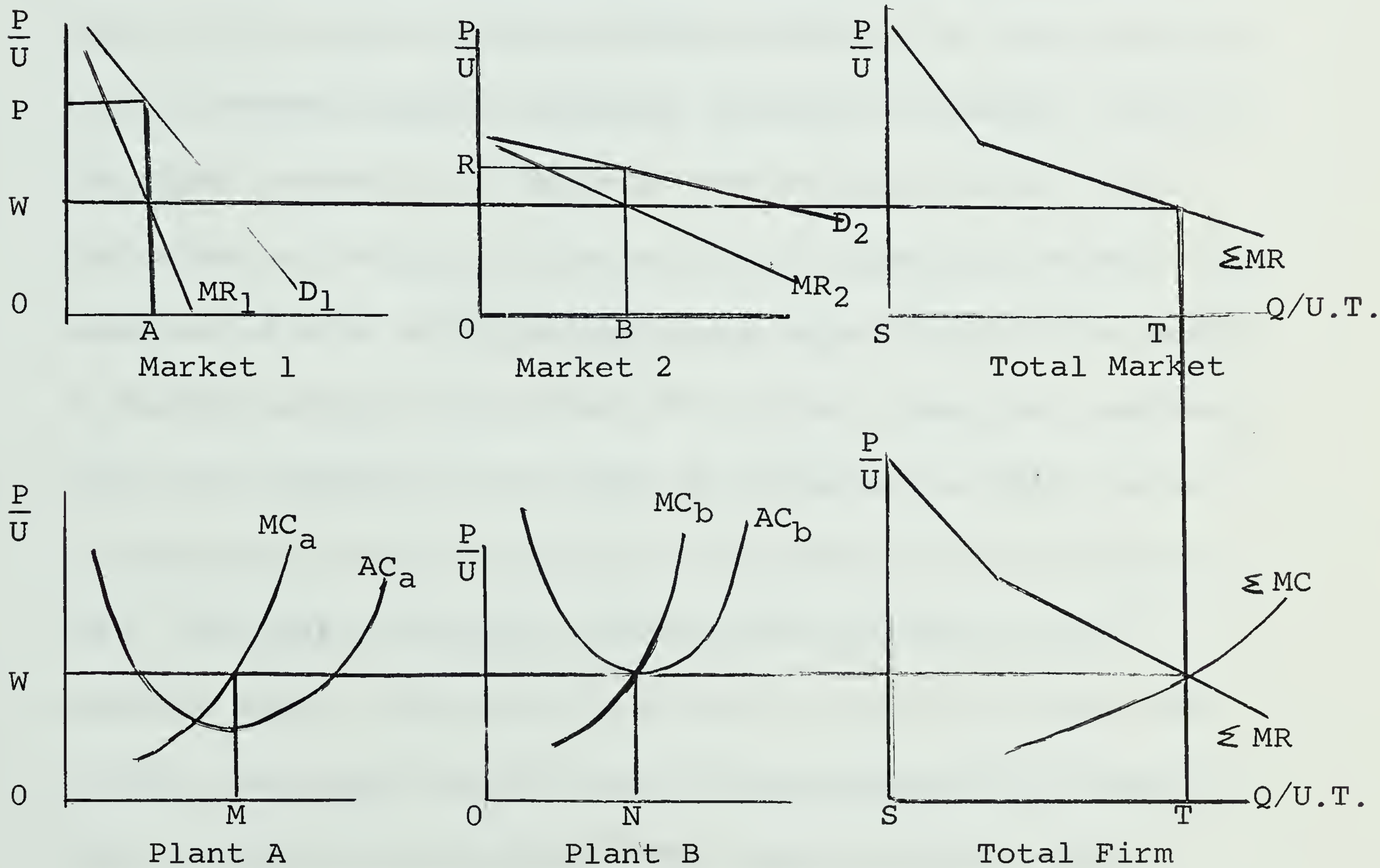

FIGURE 3

monopolist's decision-making process are applicable to an oligopolist, some important differences exist. The oligopolist by definition can exert some influence in market interactions. He can affect his output directly and thereby have some say in the price he receives for his product. The oligopolist usually does not know what changes will occur in

the demand schedule facing him when one of the other firms in the industry decides to pursue a given policy.

Oligopoly is the dominant form of business organization existing today. Nowhere is this more evident than in the petroleum industry where the various forms of oligopoly are readily observable. While the cartel arrangement is not known to the petroleum industry in North America, it is a common type of agreement existing in Europe. Many of the firms operating in Alberta have European sister firms operating (or which did operate) in an organized cartel. The legality of such arrangements is not questioned by the courts in Europe and the Middle East.[10] In North America, antitrust laws have forbidden most forms of collusion so that the cartel becomes a foreign concept to the study of the industry here. The basic concepts are very much similar to the monopoly case. The cartel acts for all firms and then subdivides the output among firms in a way similar to a multiplant monopolist allocating output among plants. The unorganized collusive type of oligopoly again contravenes antitrust laws in the United States and Canada. Some of the features associated with this type of oligopoly have never-

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[10]The International Petroleum Cartel which operated after World War II was probably the most important. See The International Petroleum Cartel (U.S. Senate Select Committee on Small Business, Committee Print #6, 82nd Congress, 2nd Session, 1952).

theless appeared in the petroleum industry from time to time.[11] Unless undue restriction of competition results, Canadian laws have allowed some collusive agreements to be implicitly assumed. Price leadership and market sharing are the most obvious. Collusion which has seriously affected the degree of competition has not been a disturbing factor on a nation-wide scale in Canada or the United States since the courts ordered the dissolution of the Standard Oil trust in 1911.[12]

Price leadership is perhaps the most widely recognized feature in the petroleum industry. Most markets have one or more price leaders and a fringe of other (usually smaller) firms which generally agree with policies set down by the price leader. As will be seen, the agreement may not be voluntary but rather brought about because of the price leader's power to determine output.

Price leadership in the petroleum industry takes two distinct forms although a price leader may fill both categories at one time. The low-cost price leader can also be

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[11]Market sharing, price leadership and resale price maintenance are quite noticeable. The degree of collusion may or may not warrant antitrust probings and subsequent court action.

[12]U.S. vs. Standard Oil of New Jersey, 221. US., (1911).

the dominant firm price leader. This is especially true in the petroleum industry where economies of scale favor the large firm. In a given market, there are few if any long run optimum size firms.[13] The largest firm will usually have the lowest per unit operating costs and therefore can act as the low cost price leader as well.

Low cost price leadership could be applied to the petroleum industry in Alberta. The sub-optimum scales of plant have resulted in higher than minimum long run production costs. The firm with the lowest costs can make the highest profits because the chief petroleum product, gasoline is sold at the same price by all refiners. If gasoline were the only product produced and two firms constituted the industry, the results could be summarized in figure 4. The low-cost firm could decide the price for both firms if the good sold was perfectly homogeneous. Assume that each firm sells exactly one half of the total market demand at any given price.[14] The low-cost will want to sell at price OP_2 if it is allowed to maximize profits. The high-cost

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[13]Just what constituted an optimum size firm was discussed in Chapter III, Supra, pp. 70-72.

[14]It could be assumed that two firms built different scales of plant because of different expectations. But the market was shared evenly so that one firm became the low-cost price leader.

firm will want to sell at OP_1. In reality, the final price would probably be in the P_1P_2 range because the high-cost firm may persuade the low cost firm to raise prices above OP_2 to restrict total output for the industry. Alternatively, a regulatory agency may depress price below OP_2. The high-cost firm could be forced out of the industry in the long run

PRICE LEADERSHIP BY A LOW-COST OLIGOPOLISTIC FIRM

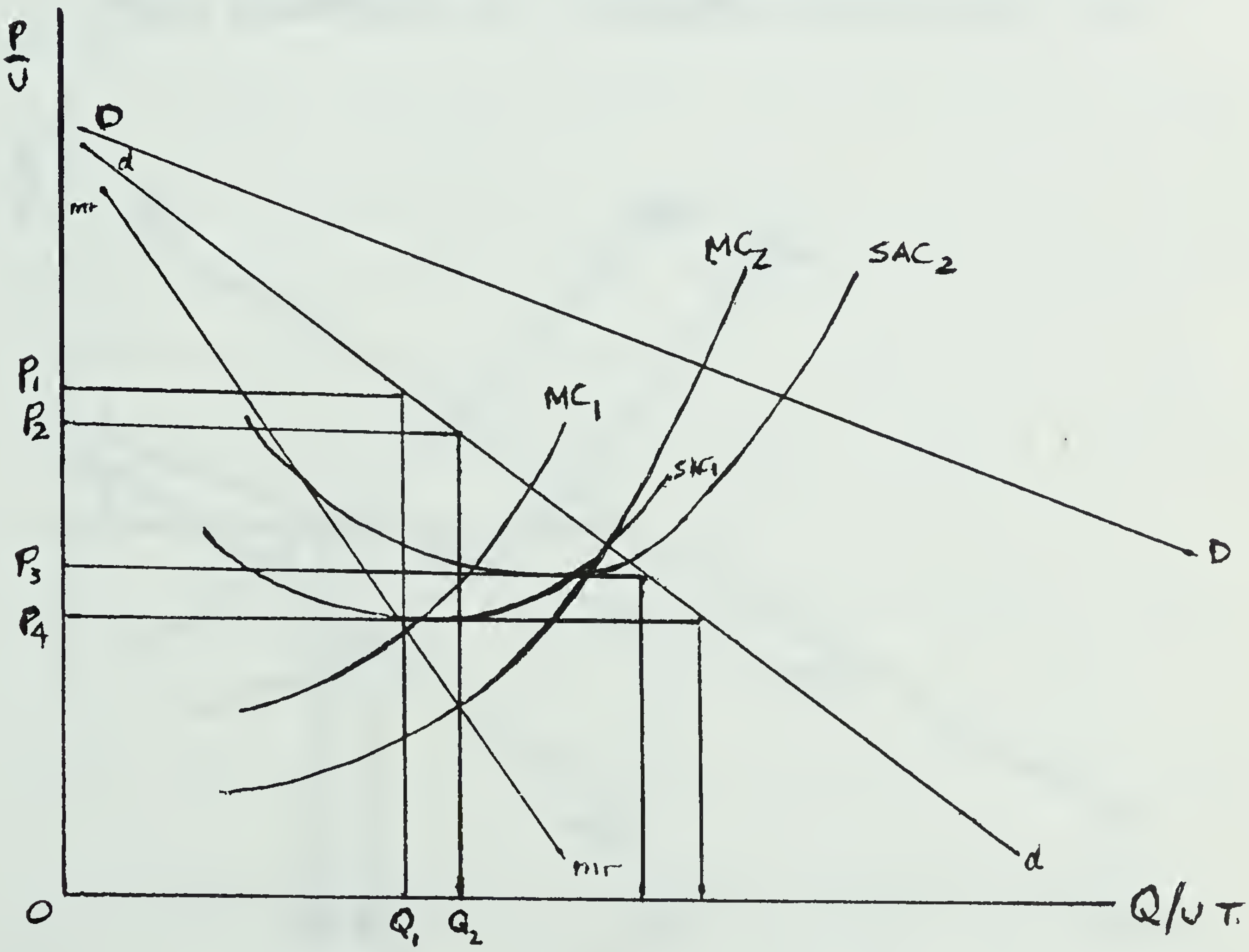

FIGURE 4

if prices fell below P_3 so that costs could not be recovered. The low-cost firm may be able to operate in the short run at prices less than OP_4.

The dominant firm leadership has ramifications in the

petroleum industry. This structure relies on price setting by one or more firms and obeyance by a competitive fringe which has no individual power to alter price. The small firms merely indicate willingness to supply the good at various prices. This can be shown by an aggregated marginal cost curve (ΣMC in figure 5). The price leader again decides

PRICE LEADERSHIP BY A DOMINANT OLIGOPOLISTIC FIRM

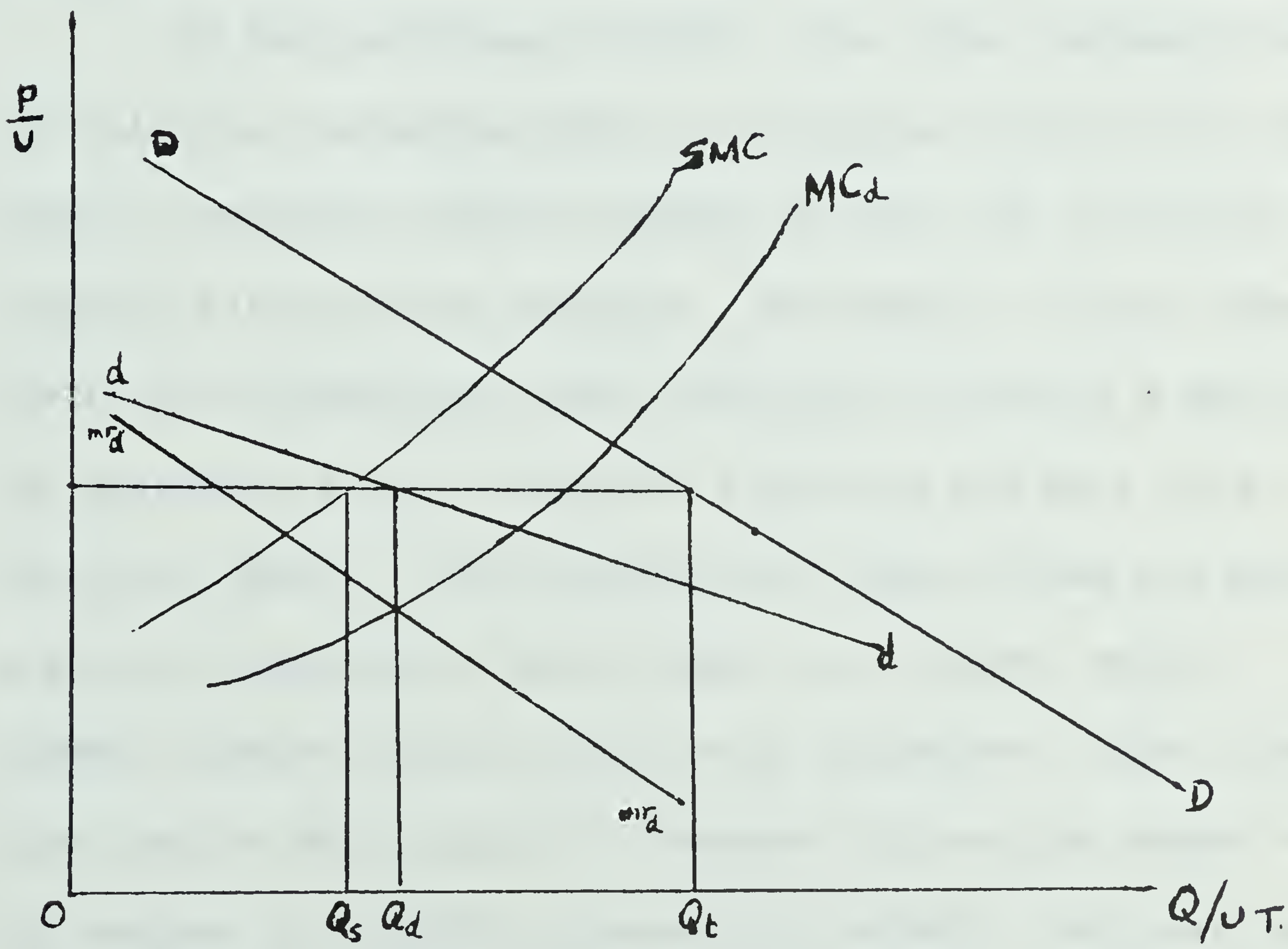

FIGURE 5

upon his price policy and lets the other firms sell at that price. However, the dominant firm must rely upon the supply curve of the small firms for deriving its demand

schedule.[15] If it desires to maximize its own profits while letting the other firms sell all that they are willing at that price, the equilibrium price would have to be P_d. Or, it may expand output and possibly drive out the competitive fringe altogether.[16] In the short run, competitive firms may operate if variable costs are covered but in the long run, only those firms able to recover total costs will operate.

In the petroleum industry, the large refiners have not only cost advantages due to economies of scale but also readily available markets because of long run contracts and national distribution channels. The smaller firms, especially the independent ones, may have to rely on a day to day existence based on shorter contracts and more volatility in sales. This may mean that small firms are more anxious to depreciate their plant in a shorter period, thereby further raising their cost schedules. Also, their plant may be more expensive because they may be unable to buy capital in a purely competitive market. The most im-

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[15] For a description of this type of leadership and derivation of the demand curves, see Leftwich, op. cit., pp. 245-48.

[16] If the dominant firm has lower costs than the small firms, it could drive them out of business by lowering price below the competitive firms' cost curves at minimum average variable cost.

portant variable factor, crude oil is available to all refiners at practically constant prices but some of the other factors may be more expensive when bought in smaller quantities. Therefore, it is impossible to assume that perfect competition can exist in all factor markets at all times. Even allowing this assumption may not give the small firm a cost advantage because its optimum size plant may not be the long run optimum size plant. This size could only be achieved with considerable growth which the small firm would not be able to achieve unless the market grew at a faster rate than that at which the large firm wished to expand. Supposedly, modern technology would continue to favor the large firm more than the small because most of the research is done by the large firms.[17] Some correlation between research and invention does exist. Innovation could be undertaken by either the small or large firms, except that large firms are able to spread the risk over more units of production and consequently charge less to unit costs. In the petroleum industry where fixed commitments form a large percentage of total costs, the advantages of a large firm are numerous. It seems reasonable to assume this dominance by the large firms, especially in regional markets, can be

[17] See Chapter V, pp. 155-156.

expected to continue for some time.

While some type of price leadership exists in the retail as well as the refining stage of the industry, a different market structure exists at the retail level. The retailers are connected to the refiners in one of several ways. They may simply buy the product and dispense it under their own brand name. In this case, the retailer is completely independent of the seller (or nearly so). He merely supplies a small portion of the total market demand. The retailer may not be able to control his own sales, however. He may be a lessee dealer or a company operator. The company may then set down policy to be followed. Another possibility is the existence of retailers who have limited working agreements with a company. This may entail exclusive buying of the company's product.

Where the refiner has some control over the actions of the retailing stage, he may institute his policies. If the market structure has already been used to decide the output of the various refineries, each refiner will then sell to retailers at prices which are not any different[18] from those quoted by other companies.

Some price rigidity may develop if a dominant firm

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[18]Some price and/or nonprice competition may exist for sales to the independent dealers.

competition would generate a vigorous price war. The phenomenon can be explained by the "kinky" demand curve first introduced by Paul Sweezy.[19] In figure 6, the accepted price OP_1 establishes a rigid price situation. The price is accepted in the sense that most (if not all) firms can maximize profits. The few firms not maximizing profits may nevertheless reap enough excess profits to discourage them from starting a price war. If new firms attempt to enter or existing firms are forced to adjust output because cost conditions have changed or excess supplies are taxing existing storage facilities, some price and output adjustments result.

The price war is a common market trait in Eastern Canada. Sometimes prices may be depressed to the point where variable costs cannot be covered. In such cases, the firm may still remain in business through a subsidy arrangement with a parent company. Conceivably, the price in one regional market could fall to zero but usually some tacit agreement is reached when it becomes obvious that no one can benefit from continuing price cuts. A firm raising prices above OP_1 will find a rapid decrease in total revenue

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[19]Sweezy, P., "Demand Under Conditions of Oligopoly" The Journal of Political Economy, Vol. XLVII (1939), pp. 568-73. See also Hall, R.J. and Hitch, C.J. "Price Theory and Business Behavior", Oxford Economic Papers, No. 2, (1939), pp. 12-45.

as its previous customers switch to other sellers. As long as the marginal cost cuts the HF range, cost changes cannot induce a firm into changing its price or output because it would be forced to take a reduction in profit. A low-cost firm (such as MC_3) could precipitate a price war by trying to maximize profits.

Pricing of Multiple Products

Single product pricing is seldom found in reality. Most firms use multiple inputs to produce many products. While an oligopolist producing 50% of the market demand for gasoline can have significant control in determining gasoline prices, that same firm may be an insignificant contributor to the total asphalt market. It may be forced to accept the asphalt price set by other larger producers of asphalt. Therefore, producers of multiple products may find they have varying degrees of control in the different markets in which their products are sold.

For purposes of exposition, the assumption of perfect competition in factor markets will be retained. However, it is assumed that some degree of imperfection still exists in the product markets even though that degree may vary widely. In Alberta, refiners spend about 80% of their variable costs for the purchase of one basic factor, crude

oil.[20] While the different grades of crude oil vary in price, the field price of a given grade of crude oil is constant. Usually, no price changes occur when varying quantities of a given crude are bought.[21] Since the other variable factors, such as power, labour and additives are bought in minor quantities relative to total market demand for these factors, the refiner will not considerably affect prices for these factors. Therefore, the assumption of perfect competition is not as unrealistic as first thoughts would indicate.

Multiple products may be produced from a fixed bundle of factors. Or, different processes may produce several bundles of products from the fixed factor bundle. Alternatively, costs could be held constant and the input mix may be varied to produce a fixed bundle of products. In actuality, variable factor input mixes are used to produce variable product mixes with or without changing processes. The petroleum industry shows the validity of these statements. Crude oil is capable of producing many different

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[20] Calculated from Dominion Bureau of Statistics, Petroleum Refineries (Ottawa: Queen's Printer, Annual).

[21] If one refiner alters the amount of crude he buys, the price for the marginal unit will not change. If several refiners alter their purchases of crude oil, price changes will occur.

products. The most desirable mix will be that which maximizes profit. But, this mix could conceivably be achieved by various refining processes.

Multiple products may be produced in fixed proportions or in variable proportions. Before development of cracking processes, a given grade of crude oil could only yield a certain percentage of gasoline.[22] Now, distillation processes can be supplemented by cracking so that the amount of gasoline which can be produced from discovered crudes can range as high as 91% by volume of crude oil.[23]

Even today, refineries which have only fractioninating towers for refining petroleum are producing fixed quantities of products from inputs of crude oil. Each grade of crude oil, measured by its "gravity" (i.e. density) has a certain arrangement of hydrocarbons which determine its characteristics. Physical breakdown of these chains will yield a certain product mix. The only way of altering this

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[22]Within narrow limits. It is estimated that average crudes (35-38°API) yield 20-22% gasoline by volume. See Vance, S., Industrial Structure and Policy (Englewood Cliffs, N.J.: McGraw-Hill, 1961), p. 283.

[23]Fractional distillation, a physical skimming process, can be supplemented by catalytic and thermal cracking which are chemical processes designed to break down molecules of the by-products of distillation. Pressure and heat are used to alter the molecular structure. See also Manne, A.S. and Markowitz, H.M., Studies in Process Analysis (New York: Wiley, 1963), p. 46.

mix is by a chemical process. The feasibility of introducing the chemical "cracking" processes depends upon the market prices of the various products.

The history of joint products in the petroleum industry will help to explain the present views regarding multiple products in this industry. The distillation process still yields about 39% of the total United States gasoline production.[24] Until 1911, distillation was the only known method of production. At that time, there was little need for gasoline because the automobile was still in its infancy stages and the primary demand was for kerosene.[25] In 1911, W. M. Burton discovered thermal cracking as a means of augmenting the fractional distillation technique when products other than those producible by distillation were desired. In 1936, Eugene Houdry introduced the catalytic cracking process. It has steadily gained acceptance by the industry until today it is accounting for 25% of United States output of gasoline. Thermal cracking produces another 25% and "stripping" natural gas yields 11% of the total gasoline production. Some gasoline is being made by the

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[24]Vance, op. cit., p. 282.

[25]For example, in 1880, 75% of the crude was converted to kerosene and only 10% to gasoline. See Cassady, R., Price Making and Price Behavior in the Petroleum Industry (New Haven: Yale Press, 1954), p. 8.

Fisher-Tropsch process which synthesizes coal hydrocarbons but this is relatively unimportant at the present time.[26]

To the extent that fixed proportions of joint products are still being produced in some refineries, the theory of pricing for these goods is still important to some. The optimum solution is easily explainable in theory if a given bundle of goods is treated as one product. It then becomes analagous to single product pricing except for one important concept. A marginal cost equal to marginal revenue situation is still applicable but the necessity of separating marginal joint costs from marginal costs for each of the products may preclude an optimum output for practical purposes. This can become especially important when the sale of one of the products may produce a smaller profit for the firm than withholding the good from the market altogether. While the marginal revenues from the sale of this good may be positive, it can be insufficient to cover the marginal direct cost of putting this good on the market.[27] At such

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[26]Vance, op. cit., pp. 282-283.

[27]The marginal direct cost is defined as that variable cost incurred when a good is marketed. This may include packaging, merchandising, etc. Production of the good may be necessary because sales of the other goods produced with these goods are profitable. It could then be more profitable to waste or store this good than to sell it.

times, a firm may calculate the costs of storing or wasting the good and using this as a basis for determining whether to sell or not.

Analysis of the fixed proportions case will entail making a simplifying assumption. It will be convenient for geometrical analysis to use a two-product model. Therefore, all products of crude oil other than gasoline are treated as one "product" and gasoline as the other product. In reality some 2600 different products are made from crude oil and this number is steadily increasing.[28]

The major problems encountered when a firm tries to determine desirable output levels concerns the difficulties in allocating appropriate costs to each product and producing these products in the quantities desired. That is, some products may not be desired in the quantities which must necessarily be produced to satisfy the desires of other consumers. The cost allocation problem has practical applications but little theoretical basis.

The economist has found that allocation of joint costs can be circumvented if an overall profit maximizing solution is the goal of the firm. The firm will then want to equate an aggregate marginal cost schedule to an aggregate

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[28]Cassady, <u>op. cit.</u>, p. 7.

marginal revenue schedule. The easiest theoretical tool for solving the variable proportion cost allocation problem is the isocost-isorevenue diagram. The cost accountant may not concur with these theories which can displace his usefulness. As a result, he has tried to separate marginal joint costs by one of three principal methods. These are the "by-product" cost allocation formula, the "sales-value" formula and the "replacement-value" formula. To employ these methods, the accountant must first determine what constitutes a product. An adequate economic definition of a product which would probably be acceptable to the accountant is "a consumable good, arbitrarily demarcated from other kinds of goods but which may be regarded for practical purposes as homogeneous within itself."[29] The demarcation may become rather blurred or may exist in the minds of the consumer only (the so called product differentiation).

Joint products may or may not be interdependent in demand. If demand for one good affects the price offered for the other, changing price relationships may exist. For example, introduction of high-powered cars could necessitate the owners to use different gasoline grades and motor oils because of new specifications set out by the automobile

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[29]Robinson, J., The Economies of Imperfect Competition, (London: Macmillan, 1961), p. 17.

[illegible]

[illegible]

[illegible]

manufacturer.

Joint costs cannot be avoided if production of at least one of the products is desired.[30] The marginal joint cost can be defined as the incremental cost of producing an additional unit of the chosen bundle.[31] Where variable proportions are involved, each bundle may vary from the previous bundle because inputs can be varied to produce only the products desired.

Common costs are often confused with joint costs. The two concepts are similar for the fixed proportions case but different for products produced in variable proportions. Common costs are of the nature of fixed costs whereas joint costs are variable with the production of the product mix.[32] Thus crude oil is a common cost for a refiner but the cost of the cracking tower is a joint cost because its intensity of use can be varied depending on the product mix desired.

The economy today is based on production of joint products. The profitability of producing the various

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[30] National Bureau of Economic Research, Cost Behavior and Price Policy (New York: NBER, 1943), p. 175.

[31] That is, a bundle C may consist of 2A + B. The incremental cost of producing another C can be found. If A and B are in fixed proportions, producing another B necessarily requires producing 2A, even if it cannot be sold.

[32] National Bureau of Economic Research, op. cit., p. 175.

[illegible]

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products has always concerned the businessman. What many have failed to realize is the undue concern attached to cost allocation. Direct marginal costs can be readily allocated but marginal joint costs may not need to be allocated except for reasons other than direct profit motives. In theory, a firm will equate marginal costs to marginal revenues even though these are both aggregated terms in joint product cases. That product mix which yields the greatest profit will be the desired mix.

Lacking perfect knowledge of marginal revenues (and in some cases marginal costs), the firm will attempt to sell products at a markup over an arbitrarily assigned cost. Just how this cost is derived will be examined. The validity of such methods will decide the firm's profits. That is, a firm must somehow allocate its costs so that profits are maximized by using profit margins which are determined by decision makers whose duty is to show shareholders an attractive overall picture of company operations.

The "by-product" method of cost allocation was one of the first to be used. It assumes that a main product (or products) is produced. Any other products are undesirable and sold at whatever prices they can fetch on the market.[33]

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[33] Ibid., p. 179.

The main product then costs the firm the total cost of producing the composite bundle less revenues received from the sale of by-products. A markup is applied to this net cost to arrive at the desirable selling price in the absence of price competition from other firms. Varying prices for the by-product could then cause one of two things to happen. If a firm desires a constant markup on its main product, it will adjust prices in response to price changes of the by-product. If the firm keeps the price of the main product constant, it will receive a varying margin.

To circumvent the varying margins, cost accountants began to adopt the "sales-value" method to allocate costs. The percentage of dollar sales accounted for by each product determined the percentage of total costs that product was expected to bear.[34] Goods produced in fixed proportions or goods produced which have no immediate market cannot always bear a percentage of costs. Goods which must be stored or wasted must be written off against present revenue from sold goods. The paradoxical situation arises when price changes occur even though costs have not changed. Either margins for some goods rise or a new cost allocation formula must be worked out.

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[34] Ibid.

The petroleum industry has adopted the "replacement-value" method of cost allocation. To the economist, this is the opportunity cost concept. Most refiners in the industry now employ this cost allocation formula.[35]

The disposition of crude oil depends on two factors. The mixture of hydrocarbons comprising a certain grade of crude oil will determine the physical limits of the product mix which can be produced. The economic limit of the product mix is determined by the price ratios of the various products. The replacement value formula utilizes this latter limit. A company decides which products it can sell most profitably. Any products which can be converted to other more profitable products will not be sold in their present state. If gasoline is the most profitable product and fuel oil is an alternative use of the crude oil, the fuel oil will be valued at a price which is equal to the price which could be gotten by converting the fuel oil to gasoline, less the cost of conversion. For example, if gasoline sells for 10¢ per gallon at the refinery and fuel oil sells for 5¢ per gallon but the cost of converting fuel oil to gasoline is only 3¢ per gallon, it would be profitable for the refiner to convert fuel oil

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[35]See for example, the statement of Esso Standard Oil Company in Lanzillott; op. cit., p. 80.

gasoline.[36] He would allocate a cost of 7¢ per gallon to fuel oil and therefore not sell the fuel oil unless the marginal revenue to be gained from the sale of another unit of fuel oil was greater than 7¢ per gallon.[37]

Accountants like to allocate these joint costs for a number of reasons. The main reason is the lack of perfect knowledge of demand and supply conditions. Many firms like to arbitrarily assign costs to the various products and then use a markup system of setting prices. Where a firm is in a position to set prices, this cost allocation formula can be used with ease. Firms in the petroleum industry, especially the price leaders use this practice.[38]

Many firms do not know how to determine the most profitable product mix because long range contracts for some products may necessitate production of other products for which the demand is not sufficient at that time. If the firms can somehow decide whether to sell some of the undesirable products, they may be in a better position to

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[36]It must be assumed that neither the price of gasoline or fuel oil will change if the conversion is made. Large scale conversion of fuel oil to gasoline may raise fuel oil prices and lower gasoline prices.

[37]For a full treatment of this concept see Manne, Scheduling...op. cit., p. 14 ff.

[38]Lanzillotti, op. cit., Standard Oil of Indiana freely admits to the usefulness of the system. See pp. 86-96.

maximize long run profits. By using a purely short run analysis, firms are not providing for the unexpected in the long run. Since the petroleum industry is composed of many corporations whose life span is supposedly perpetual, short run profits are of little interest.

The need to determine demand and supply conditions, neither of which can be held constant as the economic theorist would wish, has been perplexing to most decision makers. Since most are not operating at a truly profit maximizing output in the theoretical sense,[39] introduction of cost allocation becomes just another set of assumptions needed in the decision making model. Most firms cannot determine the shape of a demand curve, let alone a set of isorevenue curves needed for treatment of the isocost-isorevenue model. The uncertainty surrounding the most profitable product mix has led firms to allocate costs and use the markup method of pricing.

A brief analysis of the two profit maximizing solutions will be presented. Using the fixed proportions case, a firm can determine its best operating position without allocating joint costs. It will simply equate a marginal joint cost with a marginal joint revenue composed of the

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[39]See the discussion in Watson, Price Theory in Action, op. cit., pp. 53-66.

summation of marginal revenues from the sale of the various products. Using a two product case, the best operating position can be seen in figure 7.[40] If there are direct

DEMAND FOR TWO GOODS PRODUCED WITH
COMMON JOINT COSTS

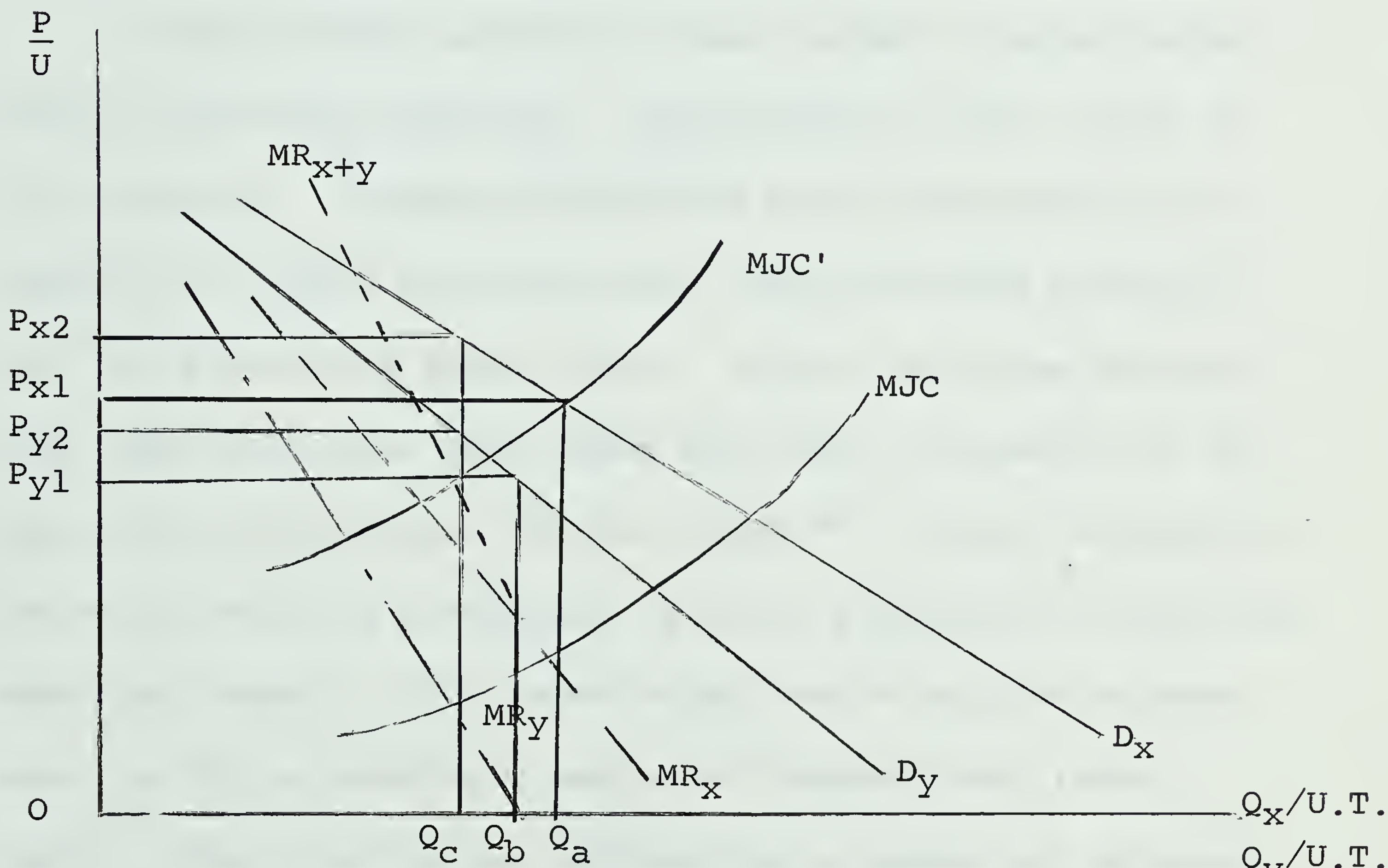

FIGURE 7

costs of further processing each of the goods, these can be separated from marginal joint costs. Assuming none exist,

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[40]The quantity axis has two scales. The scales for products produced in fixed proportions will bear a fixed relationship to each other. The marginal joint cost is the marginal cost of producing another unit of the bundle. The aggregate marginal revenue is the vertical summation of marginal revenues from the sale of each product.

the best operating position for the firm with marginal joint costs of MJC would be OQ_A. But, it must be noted that only OQ_B of product Y would be sold because its marginal revenue is negative beyond output OQ_B.[41] If marginal costs rose to MJC' both products could be sold at a profit.

The variable proportion case is best treated using isocost-isorevenue analysis. Separation of joint costs is not necessary. Academic economists have discussed cost allocation at length but have never really decided upon the need for allocating these costs. Several articles dealing with cost allocation have found that cost allocation is not simple but nevertheless can be solved.[42] If cost allocation can be omitted and a solution is still possible, the decision maker can benefit. The major hurdle which must be crossed consists of calculating a series of isocosts and isorevenues. When the two are produced on a common set of axes,

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[41] This may require an addition to be made to the MJC schedule. Costs of disposing Y must now be added to production costs of the bundle.

[42] M.R. Colbert in his article entitled "Monopoly Prices Under Joint Costs" Journal of Political Economy XLIX (1941) pp. 103-110 has tried to separate not only "direct" marginal costs for each product but also "total" marginal costs thereby treating the two products as separable (p. 109). G.J. Stigler in Theory of Price (New York: Macmillan 1946) tried to determine marginal cost of one good by observing the incremental costs of producing various quantities of the joint product while holding the output of the other good constant (p. 306).

conversion factors are needed. In order to depict isocosts and isorevenues geometrically on one diagram, it is necessary to impute the production function so that isocosts can be shown on product axes. Figure 8 shows isocosts of various factor mixes used to produce certain combinations of products. The revenues received from the sale of these products yield

ISOCOST--ISOREVENUE CURVES FOR
TWO PRODUCTS

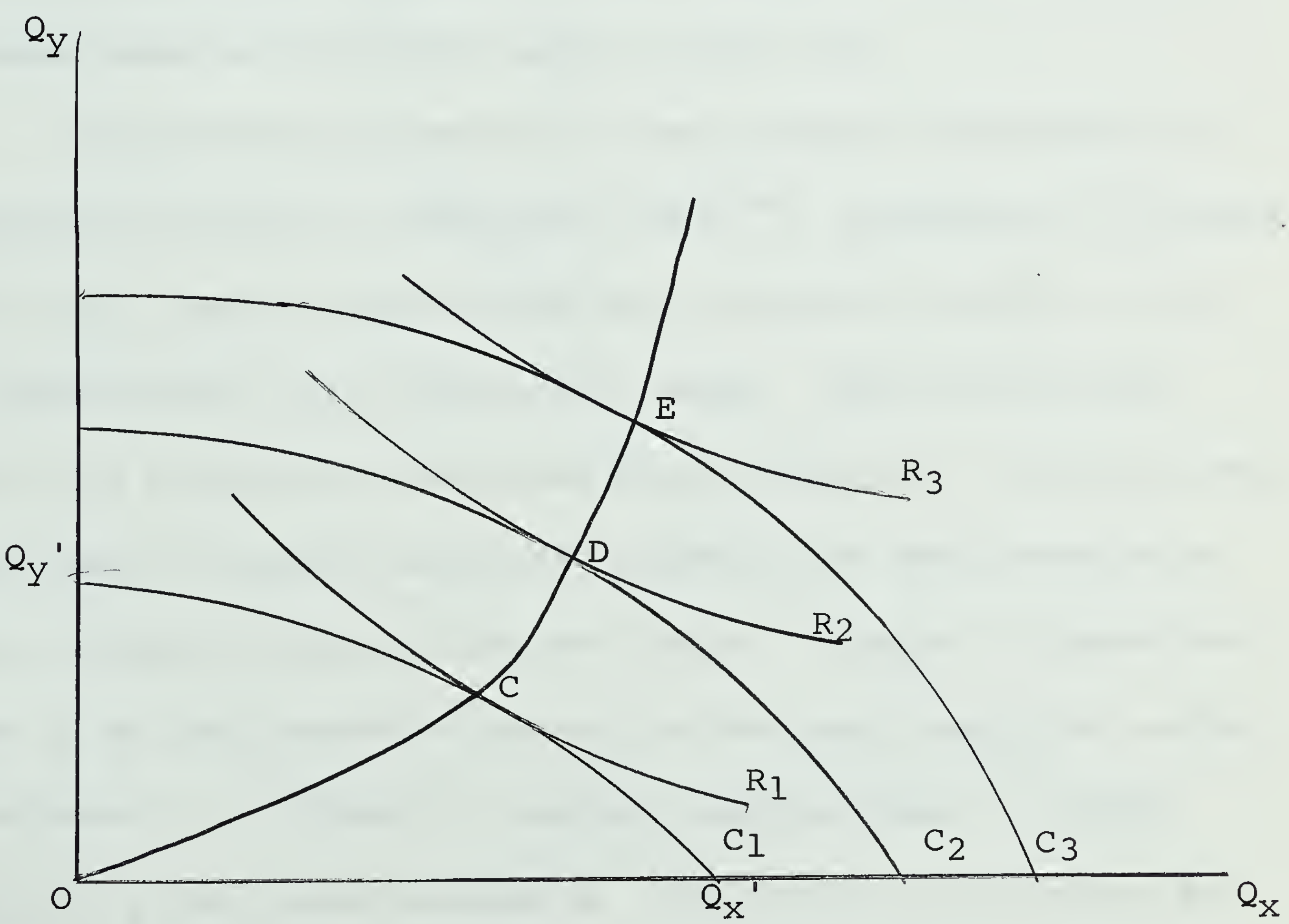

FIGURE 8

the isorevenue curves. The smooth curvature of the isocost and isorevenue curves allow finite solutions.[43]

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[43]"Normal" supply (upward sloping) and demand

A firm will want to gain maximum revenue with the smallest possible cost. Each tangency of an isocost and an isorevenue curve yields the greatest possible revenue for a given cost or alternatively the minimum cost outlay needed to achieve a certain revenue. A firm will want to expand production along the "expansion path" CDE until the dollar difference in consecutive isocosts is just offset by the dollar increase in revenues. At this point, the marginal cost of producing the product mix is equal to the marginal revenue received from the sale of that mix.

The smooth curvature of isocosts and isorevenues is seldom applicable to practical cases.[44] Lumpiness of factors will yield isocosts which may have constant marginal rates of substitution for a specified range. Where such cases arise, no single best solution may be possible. Several combinations of factors may yield exactly the same revenue so that a unique solution does not exist. A value judgment may have to be introduced to determine the most desirable output to produce. In figure 9, several combinations of inputs costing C_1 may yield revenue R. Graphically, the range EF on the isocost C_1C_1 yields a revenue R_1. Which combination

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(downward sloping) are assumed.

[44]Watson, D.S., Price Theory and Its Uses (Boston: Houghton Mifflin), 1963, p. 18.

of factors (and resulting products) is best becomes a value judgment. If one of the factors may be expected to cost more in the future, relative to other substitutable factors, it may be desirable to utilize it more fully at the present.

ISOCOST--ISOREVENUE CURVES WHERE LUMPINESS OF FACTORS EXIST

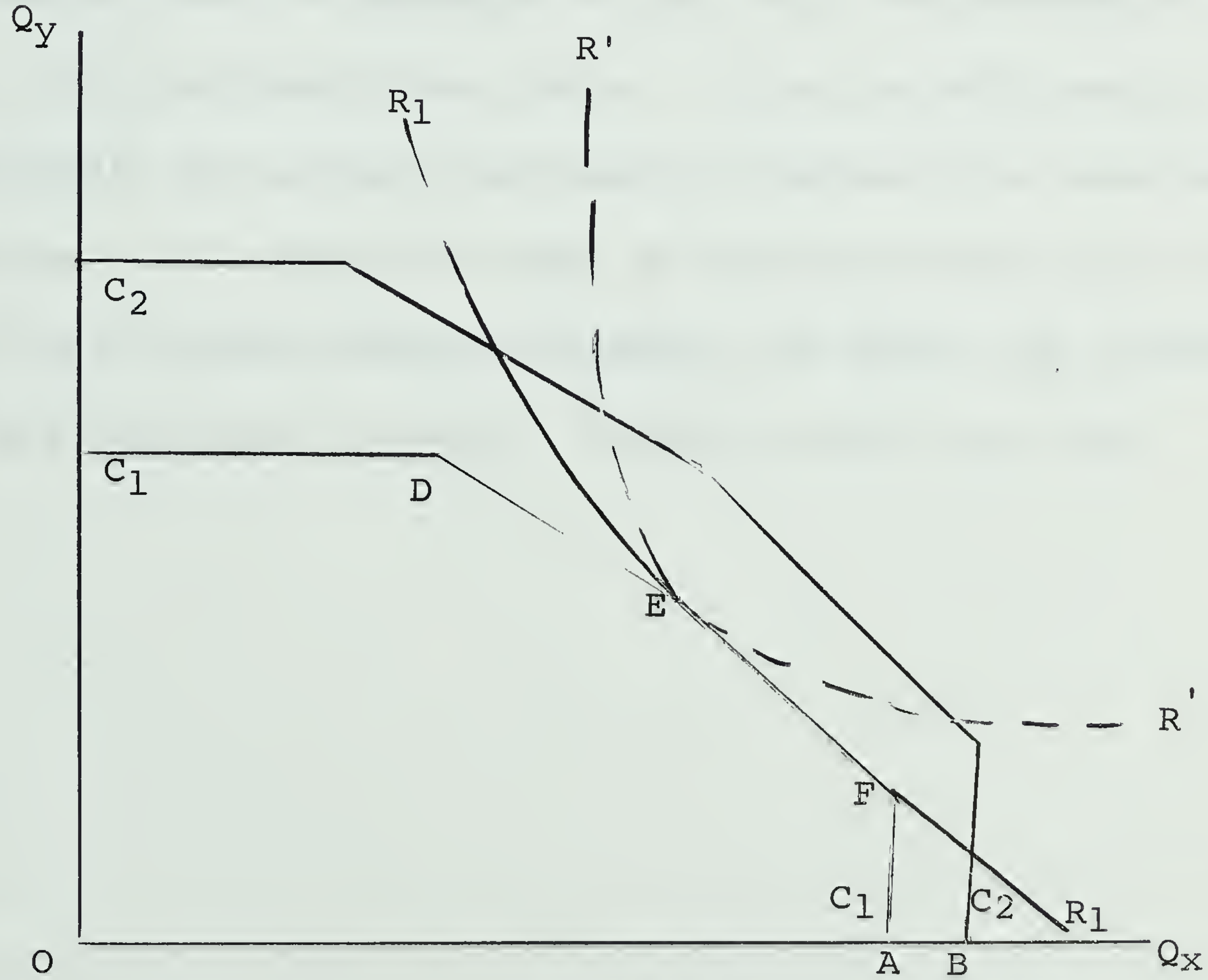

FIGURE 9

The decision maker will concern himself with not only present price ratios but anticipated future price ratios when deciding where to operate.

The pricing of joint products has been a difficult

problem for the price setters in industry. Most operate on limited knowledge of market conditions. The dynamic nature of the economy prevents the solution from being achieved unless constant adjustments are being made. Successful adjustments lead to profitable operations for the firms. Whether these are desired by the community as a whole cannot always be readily answered. To make assessments, the economist needs a knowledge of not only the observable facts but also the theoretical tools. If he has both readily available, he can use the theory to explain the empirical results. It becomes the duty of the following chapter to pull the various concepts together and assess the performance of the petroleum industry. To this we now must turn.

CHAPTER V

THE PERFORMANCE OF THE PETROLEUM INDUSTRY

To determine whether an industry is meeting a particular set of objectives in society, two things must be identified. The objectives themselves must be clearly defined, and the method of measuring the degree of attainment must be clearly set out. An industry is expected to utilize resources effectively and efficiently and allow for its self perpetuation by planning for future growth. How effectively it fulfills these objectives is determined by a rating referred to as performance of the industry. Performance is difficult to measure in concrete terms but instead becomes a relative concept. However, a series of indicators can be identified and established as measuring sticks from which an overall assessment of performance can be made. These indicators are measurable quantities even though all of them cannot be satisfied in a practical example because they are not mutually exclusive i.e. several possible combinations may yield the same best attainable result in the real world even though in theory only one optimum combination is necessary. These indicators will be examined in this chapter while the discussion of what constitutes acceptable performance will be left for the concluding chapter.

Several indicators are used to examine the perform-

ance of an industry. Some of the important indicators are profits, relationship of output to potential capacity, role of selling costs, research, and contributions to society. Public policy is used to insure that an adequate level of performance is achieved by an industry. The term workable competition has been used to define the goals which certain economists would like to see an industry attain. Antitrust laws have been designed to ensure that some semblance of workable competition is actually being achieved.

Profits have been used as a yardstick to measure success of an industry.[1] Not only is this the indicator which can be applied in most cases, but its application is most readily understood by the common populace. The economist and the accountant define profits in different ways. While the accounting version may be easier to calculate, the economic version has more validity in analysis. Only when a firm is making an economic or excess profit can discussion about high profit rates be properly introduced. Accounting profits do not tell one anything about the risk element and the expected rate of return which this risk element would require. It is not always easy to convert accounting profits to economic profits. This study will use primarily accounting

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[1]Unless otherwise specified, "accounting profits" are used in this discussion.

profit statistics and try to evaluate these in the light of risk elements involved at the various production stages so that an estimate of economic profits can be made.

There are several ways to measure profits. Shareholders prefer to know what the profit on their total investment would be. Sales departments of a firm may be more interested in knowing returns on total sales. Others may require a profit on total production for the year. While profits on investment can be used to calculate economic profits on fixed costs, these are not suitable to calculate economic profits on variable costs. Here, profits on production runs must be used. For our purposes, it will be assumed that profits on invested capital can be used to calculate economic or excess profits.

Profits for an integrated firm must be examined with some caution. Because it is diversified, risks of total loss because of poor economic conditions are less likely to occur. For the petroleum industry, the production phase involves considerable risk, especially at the exploration level. The rewards are expected to be commensurate with these risks. But this has not necessarily been the case. It is difficult to rationalize because most production costs are fixed. As a result, market conditions alone will determine the net profit from operations. Some wells have

taken very little capital for development and have yielded fantastic revenues. Others have cost more than $3,000,000 and been dry so that no revenue has resulted.[2] While risks exist at the refinery level, the wide range of products produced helps the larger refinery to absorb losses on some products while others are producing profits. The distribution and retail phases of the industry have varied risk elements. A retailer is especially vulnerable, because he is at the mercy of not only his competitors but also the refiner who has a certain amount of power in dictating the price policy to be followed by the retailer. One has only to look at the record of business failures at the various production stages to see what risk elements are involved. The turnover at the retail stage has been alarming.[3] Many producers have gone bankrupt but many of the refinery closures have not been due to bankruptcy of the company. Rather, closures imposed by market conditions have prompted refiners to look to other areas for carrying on their operations. Some pure losses could be tolerated in the short run, but in the long run, reallocation of facilities would occur if

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[2]The deepest well drilled in North America was over 23,000 feet. It was drilled in Texas and turned out to be a "dry hole."

[3]Automotive Retailers' Association of Alberta, op. cit., pp. 3-5.

these losses continued.

The Alberta government has tried to help producers to minimize risks of exploration and development by allowing accelerated production for the first seven to eight years after "spudding"[4] of the well. As some of the costs are amortized, allowable production per well decreases.[5] Reallocation of market quotas as market conditions and rates of oil discoveries change cause profit rates to vary widely from year to year. This volatility makes it difficult to calculate rates on investment which can be expected over time. Uncertainty of future revenues prevents firms from rational decision making unless accurate discounting of the future revenues can be carried out. While it is difficult to predict when and where future discoveries of oil will be made, some degree of certainty regarding potential growth of markets could be attained. If only the Canadian market had to be considered, the problems would not be overwhelming for the Canadian producer. The United States market has been troublesome because national oil policies have been unfavorable to crude oils entering the United States except at times when shortages occurred. Many producers are speculating that

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[4]That is, bringing the well into production.

[5]See Chapter II, Supra, pp. 29-30.

large United States markets particularly in the Midwest and the Pacific Northwest will be opened to Canadian producers in the near future. On this assumption, productive activity has gone ahead in Alberta even though the prospects for future growth of the Canadian market are not sufficiently encouraging to inspire exploration.

Because of the uncertainties associated with the production stage, it is difficult to praise or condemn any profit levels. A windfall profit for one firm may be associated with unfortunate losses for others. Since world crude prices are related, proximity to the larger markets has been very important. Because such is not the case for Alberta producers, their average return on investment has been generally lower than returns in other areas of the world. Examination of profit rates for the production stage of the industry reveal that returns for the industry as a whole are low. The difficulty of trying to examine an industry where failures are many shows up in the profit statements of the industry as a whole. Losses incurred by some firms are included in the overall profit thereby offsetting large profits for other firms.

Because much exploratory activity was carried out during the 1950's, many firms failed to show a profit even though prospects for long run profits were bright. It has

only been since 1961 that the producing industry as a whole began to show profits. The latest available statistics indicate that profits at the production stage in Canada have been about 4% of invested capital.[6] While this figure seems to be low considering the risk element, it must be remembered that the ratio of production to exploration is decreasing as more firms are finding that their known reserves are beginning to far exceed the production rates which the size of the market will allow. The expenditure revenue ratio for the petroleum industry as a whole has been decreasing, leading one to believe that profit rates in the future are likely to increase.

It is difficult to evaluate the actual return for the various stages because the integrated firms release only their consolidated balance sheets showing all incomes and expenditures. They try not to disclose their highly profitable operations and at the same time try to hide from their shareholders any embarrassingly poor investments.

Several estimates of pretax profits for the refining stage of the industry have been made. Cassidy's study showed that the pretax profits to the refiner on regular grade gasoline varied from 1.4% to 30.4% and averaged 20.0%

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[6] Financial Post, November 28, 1964, p. 61.

of gross sales. If two of thirty-two samples were excluded, the range was from 11.2% to 30.4% with a mean of 22.2%.[7] Allowing for an average corporation tax of 50% would mean that after tax returns on gasoline sales were 6% to 15% for most refiners and the average return for this group was about 11% of gross sales. Some products such as high grade lubricants which are made to the buyers' specifications could conceivably yield larger profits to the refiner. Other products which must be "dumped" on the market may be purposely sold to recover part of the fixed costs. As long as the marginal direct costs are covered, the good will be sold if the only alternative is wastage. Just how the profitability of each of these goods is computed depends on the cost allocation formula used.[8] Therefore, it is difficult to conclude anything from profits earned from each product. The overall profit position of the refiner must be used as a guide.

In the United States, profits of producers have generally exceeded the profits of refiners. Because of the differences in risk, this result is not to be unexpected. However, the volatility of profits at the production stage

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[7]Cassady, op. cit., calculated from Table XVI, p. 233.

[8]Supra, p. 120 ff.

showed itself during the 1950's. Examination of profits at the production stage in the United States in the early 1950's indicated an after-tax profit of about 13% compared to 6% to 7% for integrated firms.[9] Since that time the profits of producers have fallen somewhat and those of integrated firms have risen.

Integrated firms have usually made a smaller profit than independent firms performing the same functions. This may seem odd when it is considered that integrated firms are often accused of manipulating market forces to their own advantage. However, they have tended to show a profit more often. The independent non-integrated firms are traditionally very volatile when sales or profits are considered. In some years, they do very well while in other years, bankruptcy faces many. The trend of profits for both groups has been steadily upward with integrated firms following a slower rate of capital accumulation than the independents.[10] This follows from the decreased concentration noticeable in the refining industry where competition has increased considerably.

Imperial Oil is one of the few integrated companies in Canada which has consistently published an accurate report

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[9]Cassady, op. cit., p. 326.

[10]Ibid., pp. 328-329.

of profits made in Canada. Most of the others have combined their Canadian operations in the parent companies' accounts so that the public has had little knowledge of operations in Canada. Recently the government has required businesses to show the public financial statements of Canadian subsidiaries where these are operated independently from the parent firm. The rates of return after tax on capital employed by Imperial Oil ranged from 8.4% to 14.9% with a weighted mean of 11.2% for the last decade.[11] This average value closely coincides with Bain's findings regarding corporate profit rates on equity when only the top four firms in the industry were considered. The petroleum refining industry showed an after tax return of 11% to 15% for these firms. This can be compared to the automobile industry return of 21% to 25%, liquor 16% to 20% and meat packing 1% to 5%.[12] A survey of 55 petroleum refineries in Canada showed that profit rates have been declining steadily since 1960. The latest figures indicate that a 3% return on shareholders equity has been reached.[13] The falling profit rates at the refining stage can be attributed to intense price competition in the gaso-

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[11]Imperial Oil Limited, Annual Report 1963, pp. 28-29.

[12]Bain, Industrial Organization, op. cit., p. 385. See also Alderfer, op. cit., p. 280 for very similar conclusions.

[13]Financial Post, November 28, 1964, p. 61.

line and home heating markets but indications are that an upward movement as markets grow is possible. The 3% to 4% return on investment shown in 1960 to 1962 figures would indicate that a pure loss using an economic definition of profit is possible.

Examination of Imperial Oil's profits for the last decade would indicate that some excess profits are being made by that firm. While it is difficult to speculate regarding the rate of normal profits which a firm of this type should receive, an 8% to 14% return on shareholders' equity has been higher than the opportunity cost concept would dictate. A company as well established and diversified as Imperial Oil would probably not create a greater risk for the investor than a Government of Canada bond issue. Since the latter yield 5% to 6% it is reasonable to assume that profits in excess of 6% are "pure" or "excess" profits from an economist's standpoint. Texaco Canada Ltd. had declining profits from 1960 to 1963 but these have levelled at a 7% to 7½% rate.[14] It can be assumed that this company is not making "pure" losses in the economic sense.

Profits at the transportation stage are difficult to assess because many firms engage in petroleum transportation

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[14] _Ibid._

as part of their total operations. However examination of pipeline company profits shows a similar decline to those for refineries. But examination of the two major pipelines shows that profits are in the 15% to 21% range.[15] This is certainly a sizable return on shareholders' equity. Since much capital expenditure has been undertaken in the last few years, many of the newer companies have been unable to show profits. The usual procedure in the petroleum industry has been to set up subsidiary pipeline companies for gathering purposes only or else to supply the larger interprovincial pipelines with products. Fifty-nine such companies operated in 1962 but many of these were not expected to show profits simply because they had just been set up and were not able to recover their investments in a short period of time. The rapid development of pipelines in the last decade meant that investments exceeded revenues. As the initial investments are recouped, the profit made at the pipeline stage has been very large. Profits for the trucking industry have varied widely. Some of the smaller companies have made large profits for one or two years and then been driven out by the fierce competition which exists in this industry. No attempt has been made to try to analyze profit rates for truck

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[15] Ibid.

transportation because of this difficulty.

Closely interrelated with profits is the influence of cost changes and the ultimate effects for the consumer. An industry which has experienced cost changes due to change in the prices of factors or in major technological break-throughs could be expected to pass some of these cost savings to the consumer. In the petroleum industry, a major cost change in the Alberta industry occurred with the opening of the Interprovincial Pipeline. Because Alberta producers had to "meet" the prices of competitive crudes in the Ontario market, the well head prices in Alberta were forced down by as much as 40¢ per barrel. United States crude was being sold in the Ontario market at rates which were about 40¢ per barrel less than those which would have prevailed had Alberta crudes sold at their Alberta prevailing rate. Rather than impose a tarrif on United States crudes, the Canadian government decided that Alberta crude oils could be competitive if the price mechanisms were allowed to operate. The result was that average well-head price fell in Alberta by about 34¢ per barrel from 1957 to 1961.[16] A decrease in well-head prices meant that crude oil was also available cheaper to Alberta refiners. However, the retail prices of gasoline never

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[16]See Imperial Oil, Annual Report (various) and Table A-II, Appendix

reflected these cost changes. The only plausible explanation lies in the degree of elasticity of demand for gasoline. While the demand curve facing an industry is highly inelastic, the demand curve facing a firm would appear to be highly elastic. A price leader may decide to drop prices very slightly knowing that industry output cannot be increased appreciably unless a large price drop occurs. Each firm producing gasoline would follow the price leader because of the close substitutability existing among the various refiners' gasolines even though close substitutes for gasoline produced by the whole industry may not exist.

The changes in short run costs brought about by the decrease in well-head prices may have benefited the refiners in Alberta. Instead of passing on the cost savings, the refiners have elected to hold the prices of gasoline constant at the retail level while increasing quality. This has meant the cost rises over time have offset the drop in costs which occurred when price of crude oil fell. Examination of the industry over a period of time reveals that the product quality has risen noticeably while refinery price levels have been relatively constant. Retail prices have risen somewhat but part of the explanation lies in the increase in gasoline tax rates which have occurred in the last decade. The gasoline tax has risen by 2¢ to 5¢ per

gallon in Canada since 1952.[17] However, the retail prices net of taxes have been remarkably stable, rising by only 3.9% from 1949 to 1962 while the Canadian Consumer Price Index and the Canadian wage rate index rose by 30.7% and 87.5% respectively. During this period, the octane rating a measure of gasoline quality used by the industry, increased from a rating of 81% to 93% for regular gasoline.[18] This quality increase cost the petroleum industry approximately 1.2 billion dollars. It is difficult to estimate how much of the quality increase can be attributed to research done in Canada but estimates made for the industry in the United States place a $200,000,000 price tag for increasing the octane rating by one point.[19] While product improvements have involved costs which the consumer has not been asked to bear in the form of higher prices, the drop in crude prices has also been absorbed by the refiner. Virtually no research is done by the refining industry in

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[17] The tax rates have risen 3¢ to 5¢ per gallon in the Maritimes. Only Alberta, Ontario and Quebec had 2¢ per gallon tax rate changes. The total tax rate varied from 12¢ per gallon in Alberta to 19¢ per gallon in Newfoundland and Nova Scotia. The weighted Canadian average in 1963 was 13.53¢.

[18] Imperial Oil Limited, Statistical Summary presented for a conference in Sarnia, May, 1963, p. 32.

[19] American Petroleum Institute, Petroleum Facts and Figures, 1959, p. 148.

Alberta, but most Alberta refiners rely upon research facilities of the parent firms so do bear some of the research costs. It is not altogether clear how much the Alberta refiners allocate to research done for them by the parent company because consolidated financial statements dealing with operations for the whole company are the only available sources of information. Since some refiners are also producers, the cost decrease for the refiner may have been offset by a profit decrease for the producer.

Another indicator used to examine industry performance is the relationship of achieved output to potential capacity. While output can usually be measured in physical units, capacity is not always readily measurable, especially if output is not pressing on the use of available facilities. Capacity is usually something larger than present output but how much larger may be subject to some estimating by the decision maker. The petroleum refining industry capacity can be defined quite readily. Capacity measured as the daily throughput in barrels is a function of the diameter of the various pipes, the sizes of the fractionating towers and the time necessary for the various distillation processes to take place.

Refiners have tried to maintain a high output capacity ratio by increasing capacity only as market conditions

require. This is possible in the petroleum refining industry because additions to certain steps in the refining process are readily made on a piecemeal basis. Refiners have chosen to increase capacity by small increments because many of the fixed factors needed are divisible. One would expect that the output capacity ratio to be found in the refining industry would be high. But this has not been the case. Some excess capacity has occurred in the industry because some small refiners have operated at less than capacity outputs for some time before curtailing operations. The explanation for not closing the refinery altogether can be based on two factors. Some refiners hoped that market conditions would improve and they would have been able to operate at higher outputs in the future. Others operated as long as they could cover variable costs fearing a shutdown, would mean losses of fixed costs.

Excess capacity in the petroleum industry in Canada reveals that firms are not operating plants at their most efficient outputs from a resource allocation standpoint. Since 1950, the production-capacity ratio in Canada has never been higher than 86.2%. Approximately 15% excess capacity has existed during most of that period.[20] Because fixed costs form a large proportion of total costs in the petroleum

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[20] See Table A-VII., Appendix

industry, many oil company executives feel that the petroleum industry in Canada has to operate at production levels exceeding 90% of capacity to show normal rates of return.[21] If optimum resource allocation is the goal of the petroleum industry, excess capacity misallocates resources. However, if normal rates of return are considered adequate measures of performance, some excess capacity could be tolerated. Unfortunately, the structure of the Canadian petroleum industry suggests that future excess capacity will continue to exist. While the concentration of industry output by the top 4 or 8 firms might not rise in the near future, there are indications that control of the industry by American, British and Dutch "majors" is certainly not diminishing. No exact figures are available but speculation has persisted that the large companies will continue to invade sectors of the Canadian market. These large companies are willing to operate with excess capacity as long as competitors are forced to do likewise. The constant invasion of sectors of the Canadian market by many large firms has certainly indicated this to be true. These firms would rather operate at little or no profits than cease operations and leave a potentially profitable market to competitors. Therefore only

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[21] Interview with J.N. Love, op. cit., revealed this situation to be felt throughout the industry.

exceptionally rapid growth of the market will wipe out excess capacity. The combination of excess capacity and continued entry of new firms suggests that long run profits for the Canadian petroleum industry must be encouraging.

While excess capacity has been chronic rather than cyclical in Canada, the opposite has occurred in Alberta. The production capacity ratio has varied from 0.782 to 0.987 averaging 0.878 from 1950 to 1961 inclusive.[22] Some correlation between the business downturns of 1954 and 1959 and excess capacity in Alberta is noticeable. The cyclical nature of excess capacity in Alberta can be expected because of the correlation between petroleum product consumption and personal income. Chronic excess capacity suggests over-expansion of the industry. On this ground, the Alberta industry appears to fulfill the efficiency role rather well.

Another indicator which may help in evaluation of the petroleum industry is the role of selling costs in the total cost structure. Only those who consider high selling costs as a misallocation of resources would consider this point as an indicator of performance. It can be argued that selling costs should be kept to a minimum because few physical resources are employed in selling goods. However, in our

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[22] Table A-VII, Appendix.

society product differentiation has become a very important aspect of business activity. To create product superiority or brand preference, advertising is necessary. The proportion of resources which must be devoted to advertising varies widely from industry to industry. It is not always easy to determine the amount of advertising which is most beneficial for each product. While the marginal conditions can be applied, the marginal revenue to be gained from sales cannot always be broken down to causal factors. Therefore, the amount of advertising necessary for any industry is largely decided by trial and error.

Selling costs are very important in industries which rely heavily upon product differentiation. Products which have a low value per unit may have to bear high selling costs. For example, a one minute television commercial for the soap and detergent industry will cost the same amount as a one minute commercial for the automotive industry. While this commercial may be responsible for the sale of one additional automobile, the equivalent revenue for the soap industry may require the sale of 10,000 units of soap. In reality, the soap industry has found that more than 10% of sales revenue are used for selling expenses while the automobile industry uses but 2% to 4%. Producers' goods such as cement, steel and rayon bear small selling costs relative to sales revenue,

commonly less than 1%.[23] A similar proportion, 1% to 2% of total revenues, are spent by the petroleum refining industry for advertising and other selling costs. Because the petroleum industry sells many of its products as producers' goods, advertising must be devoted primarily to those goods which are designed for sale to the final consumer.

Gasoline advertising can be classified into two categories, informative and retaliatory. Since the industry demand curve for gasoline is relatively inelastic, advertising by the industry as a whole could do little to increase industry sales of gasoline unless other factors such as income, number of automobiles and highway mileage rose rapidly. However, advertising of gasoline by the petroleum firms can create demand for complementary goods. Each firm's advertising budget is usually designed to inform the consumer of new developments and advantages of a particular brand as well as to counter the advertising campaign of competitors. The role of informational advertising should not be overlooked. With octane ratings and additive content changing constantly, many firms feel that this type of advertising is both advantageous and informative for the consumer.[24]

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[23]Bain, J.S., Barriers...op. cit., p. 179.

[24]Ogilvy, D., Confessions of an Advertising Man (New York: Dell Publishing, 1963), p. 136.

Each firm is trying not only to create demand for gasoline but also to increase its share of the market. Realizing that gasoline is somewhat homogeneous even in the eyes of the consumer, many firms have concentrated their advertising campaigns to promote the service and nonprice benefits associated with the purchase of gasoline.

The petroleum industry is one of the few which pays practically all of its advertising costs at the refining level. Retailers have almost no advertising costs with the exception of some informational advertising for announcing hours of service or opening of new facilities. Most other industries rely on their retailers to supplement national advertising campagins with local campaigns. By consolidating advertising costs at one level of production, less duplication of facilities results. Consequently, less advertising expenditure relative to total sales revenue is needed in the petroleum industry. By being able to devote but 1% to 2% of sales revenue to selling costs, the petroleum industry can offer the product to consumers at a cheaper price than would be the case if selling costs formed a larger proportion of total costs.

Examination of the research and development (hereafter known as R and D) expenditures could be used as another indicator of performance. These subjects have been of particular concern for those Canadians who feel that the fruits

of research are only available in Canada if research is undertaken in the country. Most Canadian industries have done very little research for themselves. They have relied on parent companies in the United States to do research for them or in other cases, have commissioned research agencies to conduct the research for them. While this borrowing of technology may save Canadian consumers money, they may be forced to accept goods which are not produced specifically for the Canadian market. Inasmuch as some correlation exists between research expenditures and inventions, firms which do little research may be unable to offer new products from time to time. Goods which can be efficiently mass produced in the United States using technology developed there may not be suitable for the smaller Canadian market or cannot be economically produced in Canada using American technology. Much of the lower productivity noticeable in Canada can be attributed to failure to adopt distinctive Canadian methods of production. If Canadian firms were to do much of their own research and development, the stimulation of employment and slowing of the "brain drain" would be beneficial to Canada.

In the petroleum industry, only Imperial Oil and British American Oil have maintained research facilities which might be termed commensurate with the size of firms operating here. The Federal Department of Industry has

estimated that an American petroleum firm spends 4.9 times as much for research and development as a Canadian firm of the same size. Whereas a Canadian firm in the petroleum refining industry spends 1.7% of its value added for research, the American firms spend 8.6% for that purpose.[25] The expenditure-value added ratio for research by the petroleum industry has been high compared to other industries in Canada, averaging about twice the Canadian average for manufacturing industries. In the United States, however, the expenditure value added ratio for the petroleum industry is but 1.3 times the national average. Because the petroleum industry is largely controlled in the United States and most of the research is usually done by the parent company, one would expect heavier reliance on American research in the petroleum industry.

The results of research done by the petroleum industry in Canada and the United States seem to bear fruits in the form of continuous changes which have taken place in the chemical content of gasoline. The quality, measured in terms of antiknock properties and rated by octane numbers, has increased almost every year. Besides the overall increase

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[25] Financial Post, March 20, 1965, p. 25. Some discrepancies in the method of calculating value added may occur but it can be assumed these are relatively minor.

in quality, new blending techniques to allow for changes in weather and geographic conditions have been introduced. Every region has gasoline which is unique. Each season of the year sees new blends introduced. For example, anti-freezing compounds are added in the winter. With the continuous changes needed it would seem that research is a necessary and vital part of the industry. However, a central research center can develop the various blends needed in the different regions of North America. Duplication of facilities can be costly so the petroleum firms have relied on a centralized research center with the various divisions or subsidiaries bearing their proportionate share of costs.

Inasmuch as the petroleum industry does more research relative to value added than most other manufacturing industries, it is interesting to examine the reasons for this. The high degree of concentration can explain some of this. Traditional theory has favored the oligopoly firm making excess profits as an acceptable market force because some barriers to entry can allow a firm to undertake research without fear of being unable to recoup its research expenditures.[26] Hamberg, in his study of firm size and re-

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[26]Schumpeterian analysis favors the "monopolistic" firm because it can invent and innovate without fear of immediate competition.

search[27] finds that most research is done by the giant firms. In the petroleum industry, the corelation coefficient for research and employment by firms was 0.92 in 1960. The coefficient relating research and assets by firms was 0.89.[28] Large firms are able to carry out more research not only in absolute but in relative terms. It is not surprising that the largest firms do more than their proportionate share of the research. Imperial Oil in Canada does more than 50% of the research done by the industry while its capacity is but 36% of industry capacity. While they have not developed the basic technological processes used in the petroleum industry, much of the product improvement in Canadian products can be attributed to research done by Imperial Oil.

Research dealing with production technology done by the large firms is disadvantageous for the petroleum industry on the prairies. Small refiners are not able to utilize techniques which are perfected by the large refiners for uses in their plants. Cost savings will usually be available to the large refiners as long as the small refiners refuse to develop processes which will benefit them

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[27] Hamberg, D., "Size of Firm, Oligopoly and Research" Canadian Journal of Economics and Political Science, Vol. XXX, 1964, pp. 62-75.

[28] *Ibid.*, p. 67.

exclusively. Because research is very costly and results are unpredictable, the major portion of research done in Canada will continue to be devoted to minor product improvements rather than means to develop revolutionary production techniques.

The final indicator used to examine the petroleum industry will be contributions to society. These may be monetary, pecuniary or goodwill. Contributions which can be measured in monetary units are easily classified. Some industries have to rely on other means to project their image. All industries must maintain good public relations and provide certain services for the public. These cannot always be readily measured and assessments must be based on value judgments.

Monetary contributions to recognized institutions are most readily associated with contributions to society. Here taxes imposed are not treated as contributions to society because they are not paid willingly, even though the benefits to society as a result of taxation are numerous. Contributions to be considered here are those voluntarily paid by a firm to educational, cultural, welfare of health institutions. Studies of company contribution habits have

been undertaken by the National Industrial Conference Board.[29] They found that average company contributions as a percentage of profits before tax ranged from 1.0% to 1.5% with a mean of 1.2%. The mean for the petroleum industry was 1.1% with a range from 0.7% to 1.9%. Before the cancer scare caused lagging sales in the tobacco industry, that industry gave up to 5.8% of its pre-tax profits to charity while the non-metallic mineral industry gave but 0.6% to 0.8% of pre-tax profits to charity.[30] Remembering that petroleum industry profits were high relative to many other industries, the rate of giving was not overly generous.

Health and welfare institutions have been the principal beneficiaries in Canada, receiving 48% to 53% of total contributions while education received 36% to 38%. The petroleum industry has been able to benefit from research done by universities and other educational institutes. This explains the heavier emphasis on grants to education by this industry. Contributions to education ranged from 39% to 46% of the total contributions by the petroleum industry.[31]

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[29] Watson, J.H. and Douglas, M., Company Contributions in Canada (NICB, Montreal, 1963). See also the 1964 Supplement.

[30] Ibid., p. 6 and Supplement, Table I.

[31] Ibid., p. 28 and Supplement, Table V.

The performance of the petroleum industry cannot be easily summed up using only one or two indicators. However by using many indicators, the extremities may become de-emphasized and the average results become those most readily acceptable. For example high excess capacity is not a favorable indicator for performance of an industry if optimum allocation of resources is a goal. If elimination of excess profits is desired, excess capacity may be an acceptable indicator. It then becomes a value judgment to decide how much excess profits can be tolerated if an industry meets the criterion of no excess capacity. Alternatively, if the criterion is elimination of excess profits, one must decide if a limit on excess capacity is to be a further constraint. Unless some system of weighting can be attached, it is impossible to critically examine the industry by making an overall statement to cover all of the indicators. Some of the results may become easier to interpret if public policy is examined. Since it is the role of antitrust legislation to protect society and the economy from misallocation of resources, effectiveness of such legislation can predetermine performance. Unfortunately, the law in Canada has not been forcefully interpreted and restraints to offending companies have not been issued at times when considerable doubt regarding integrity and actions not conducive to the public

interest have arisen. The antitrust laws in Canada are not designed to promote perfect competition, nor are they designed to promote monopoly. What actually results may be a monopoly situation, however, because protection offered by the Patent Act is respected by the Combines Investigation Act. Another example would be the "natural" monopoly created because a market can support only one firm. The main intent of Canadian antitrust legislation is the maintenance of some degree of "workable competition". This term has received considerable publicity since it was first coined by J. M. Clark in 1941.[32] He argued that:

> "Perfect competition does not and cannot exist and has presumably never existed....What we have left is unreal or ideal standard which may serve as a starting point of analysis and a norm with which to compare actual competitive conditions."[33]

Workable competition was judged to be the ideal performance of an industry. This could range from nearly perfect competition in some industries such as wheat farming to natural monopolies in other industries such as power utilities. Canadian legislation has been based on the word "unduly". Only where existing competition causes conditions which

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[32]Clark, J.M., "Toward a Concept of Workable Competition", American Economic Review, Vol. XXX, 1940, pp. 241-56.

[33]Ibid., p. 241.

"prevent, limit, or lessen unduly" the degree of competition deemed necessary to supply a given market at a reasonable price will antitrust actions be taken.[34]

What, then, is workable competition? How is it possible to measure the desirable degree of competition? The answers are not easy to find, if they can be found at all. It is up to the restrictive trade commission and the courts to define what ideal would constitute workable competition. Since no two industries are identical, each case must be judged on its own merits. However, an Attorney General's committee in the United States tried to define the term in a broad sense. Here is a portion of their definition:

> "The concept of "workable" or "effective" competition can perhaps best be described as the economists' attempt to identify the conditions which could provide appropriate leads for policy in assuring society the substance of the advantages which competition should provide...
>
> The basic characteristic of effective competition in the economic sense is that no one seller and no group of sellers acting in concert, has the power to choose its level of profits by giving less and charging more....To bring this result about, it is necessary that rivals be free in fact to compete by lower prices..., if they can achieve low enough costs to do so, and that no seller have power to limit this freedom of his rivals and thus escape the pressures and penalties which effective competition imposes."[35]

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[34]Deutsch, J.J., et al, The Canadian Economy (Toronto: Macmillan, 1961), pp. 41-44.

[35]Quoted in Britnell, G.E., et al, Workable Competition and Monopoly, submission to the Royal Commission on

A strict interpretation of this definition of workable competition is difficult to justify. It is virtually impossible to find an oligopolistic firm which cannot exercise some degree of power and hence control its output. While the Schumpeter-Clark School would favor retention of some degree of power, economists such as Bladen are violently opposed to any forces which may destroy this competition.[36] These latter views have now been largely overlooked by the courts. Courts are more concerned with prevention of predatory tactics designed to lessen competition not for the sake of increasing market shares by the remaining firms but those designed to allow future output restriction. High profits and poor service may result if these predatory tactics are allowed to go unchecked.

Antitrust laws have been forceful in writing but weak in application. In Canada, the number of convictions has been very small. No industry-wide involvements such as the Alcoa case, arrest of top officers such as the General Electric case or divestment of control such as imposed on DuPont in the General Motors case have occurred in Canada.

Canada's Economic Prospects, May, 1956.

[36]Bladen, V.W., Competition and Monopoly and their Regulation, submission to the Royal Commission on Canada's Economic Prospects, January, 1956.

Only the Canadian Breweries case first started in 1951 and finally dismissed in favor of the defendant attracted considerable national attention. The only post-war case involving the petroleum industry to reach the courts dealt with collusion to fix prices in the Vancouver area but the courts rules that "specific detriment" to the public was the only grounds for prosecuting price fixers.[37] The restrictive trades practices commission is constantly investigating complaints and will order guilty parties to change their tactics or be faced with court actions. Where such guilty parties were found, restraining orders were sufficient to stop the companies involved from further pursuing their policies.[38]

The petroleum industry in Canada has not been charged for taking courses of action detrimental to the public interest. While trading arrangements may lessen competition, they do serve a useful purpose by allowing retail prices to be kept commensurate with transportation costs from the

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[37]Rosenbluth, G. and Thorburn, H.G., Canadian Anti-Combines Administration 1952-1960 (Toronto: University of Toronto Press, 1963), p. 64.

[38]Several reports concerning distribution and sale of gasoline in the Toronto area were submitted by the Restrictive Trades Practices Commission to the Minister of Justice in 1960 and 1961. Either the charges were dismissed or restraining orders were issued to the guilty companies. Compliance with orders meant that court action was not necessary.

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nearest major refinery. Using this basis, it can be seen why little antitrust action has been taken against the major oil companies. The price policies in the industry have led to reasonably high profits. Because of the inelastic nature of the demand for such products as gasoline, industry output restriction cannot be considerable before large price rises are noticeable. When price rises occur, public outcries are usually heard. Relatively stable prices for gasoline over time suggest that reasonable profits must have been possible at present price levels. Despite these stable prices, it could be argued that the petroleum industry is not operating in the public interest when excess profits are being made. For the industry as a whole, these excess profits do not exist. However, the larger firms are able to make an excess profit because they allow the smaller firms to operate. They do so by allowing prices to exceed the operating costs of large firms, although these prices may not necessarily exceed the small firms' costs. If the large refiners sold their output at average unit costs, the small refiners would be driven out of business in the long run because of their higher average cost schedule.

To escape detection by a restrictive trades commission, the majors have chosen the alternative of deliberately holding prices in Alberta higher than necessary for

normal profits. In Alberta, the situation is particularly noticeable because ten refiners could operate in 1961 and presumably make some profits. In Ontario, where the capacity is roughly three times as large as in Alberta, only seven refiners existed. The Edmonton refineries serve a population of some 700,000 people from three refineries and three more refineries serve another 700,000 people. The remaining four refineries served very few. The three refineries in the Toronto area have a market in excess of 5,000,000 people while the three Sarnia refineries serve the same 5,000,000 people because both refinery areas are located close to the centre of the major population areas. Thus, little duplication of facilities is needed and one refiner can serve the whole Ontario market. As a result the competition becomes extremely intense and market sharing may be an unacceptable alternative. Since all of the refineries in Ontario (with the exception of Fort William) have large capacities, unit costs for each show less variance than Alberta unit costs for the various refineries. The cost differences for the various Ontario refineries are small so that the majors cannot readily drive the smaller firms out of the business by selling at large firm average costs. There is not much to be gained by deliberately trying to hold prices high because all of the Ontario refineries are owned by

majors and no clear leader exists. Sooner or later, one of the companies would decide to break the agreement and reduce prices to gain a share of the market. When this starts, retaliation is invited. Therefore, low refinery margins have been established at the outset and competitive forces have kept these.

Deliberate condemnation of the Alberta industry for a somewhat artificially high price level for its products is perhaps too harsh. Attempts to foster competition in the face of mounting odds can lead to misallocation of resources. New technology has favored growing firms and larger plants. Therefore, it seems unreasonable to expect inefficient plants to remain in business. By so doing they are implicitly pleading for protection which free market forces would be unable to provide. The variance in cost schedules between smaller and larger firms has led the large firms to offer protection to the small but at the same time consumer prices have been higher than they would have been had a free market operated where no price administration was possible. Some Alberta residents feel that gasoline prices in the province are too high. To bring about an economically feasible solution would involve some drastic changes in the structure of the industry. If the large firms are allowed to operate according to truly competitive forces, lower prices to the

consumers can be expected. Unless the product mix can be altered sufficiently to favor the Alberta consumer, it is unlikely that gasoline prices will drop in the near future. In the light of constraints imposed both by the limited product mix and the existence of small firms, the large firms are trying to operate efficiently while protecting the smaller firms.

CHAPTER VI

CONCLUSION

Examination of some aspects of competition in the petroleum industry leaves several problems unanswered. It must be determined what constitutes an acceptable performance. This involves defining performance and determining what norms are to be set for a given industry. But it is insufficient to conclude that problems exist. Some tentative solutions must be offered. Here the real problem area develops. Any policy measures are difficult to implement unless a real need for these measures exists. In an industry such as the petroleum industry, several opinions usually exist. Loud outcries would be heard if drastic policy measures were introduced. Being a large industry made up of many capable people, the petroleum industry has problems in trying to operate in the best interests of the industry without sacrificing the interests of the public which is being served.

Policies designed to reallocate resources may be of interest only to those who feel that an ideal industry performance can be achieved only when resource uses satisfy the

Paretian conditions of optimality.[1] Recently, a new school of thought has developed which still believes in the Paretian conditions but realizes that these are seldom, if ever, attainable. The theory of second best has been developed to explain the best position attainable if the Paretian conditions cannot be satisfied.[2] If a certain resource allocation pattern is the desired goal of policy makers, policies designed to bring actual performance closer to this goal would be considered to be desirable. Unless it can be determined what constitutes desirable performance, it is clearly meaningless to design policy.

The problem of defining performance has been circumvented in most studies dealing with evaluation of industries. Whether this is because of the difficulty of defining the concepts or the necessity of introducing value judgements has not been made clear. For our purposes, performance will be defined in terms of resource allocation. Ideal performance

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[1]If the seven marginal conditions dealing with choice, production, and exchange are satisfied, a point on the Paretian frontier is reached. Which of the several points is chosen depends on other factors such as the social welfare function or the decisions of policy makers. For a good discussion of these conditions, see Reder, M.W., Studies in the Theory of Welfare Economics (New York: Columbia University Press, 1947) pp. 21-38.

[2]Lipsey, R.G. and Lancaster, K., "The General Theory of Second" Review of Economic Studies XXIV (1956-1957), pp. 11-32.

would then be synonymous with optimum resource allocation. In order to attain this ideal, satisfaction of all seven Paretian conditions is necessary. This is theoretically possible but practically impossible. The necessity of simultaneously satisfying all the marginal equations dealing allocation of products, factors and time preference precludes the attainment of the Paretian frontier in today's economy.

Perfect competition was long considered as being the ideal form of competition because it could satisfy the Paretian conditions. Unfortunately, the time preference condition cannot be adequately satisfied by perfect competition. Since knowledge is perfectly disseminated, the benefits of research by a perfectly competitive firm do not accrue only to that firm but to other firms as well. This was not fully realized until Pigou and later Lerner examined the social costs and benefits of welfare maximization and compared these with private costs and benefits.[3] Furthermore, the problem of choice arises in a perfectly competitive economy. While choice among products from various industries exists, the homogeneity of products produced by a given industry prevents consumers from showing preferences for

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[3]Pigou, A.C., The Economics of Welfare (London: Macmillan, 1920) Part II, Chapter II-IV, and Lerner, A.P., The Economics of Control (New York: Macmillan, 1944), Chapter 5.

products from a certain firm within a given industry.

Since research and some heterogeneity of products are now considered desirable for continued satisfaction of wants over time, the ideal of perfect competition is no longer considered practical. Since perfect competition cannot adequately satisfy the Paretian condition of time preference, satisfaction of the other conditions does not necessarily mean that perfect competition is superior to other types of economic entities. The theory of second best showed that unless all of the Paretian conditions were satisfied, satisfaction of more rather than less did not necessarily mean that welfare was increased.[4]

If the Paretian frontier is still accepted as the ideal but perfect competition is rejected as an ideal because research and choice among alternative products within an industry are not available, the best position attainable may be either a second or third best. Workable competition can then be defined as the ideal solution which results when certain constrained conditions are satisfied. This then becomes a third best solution. In certain cases, it is far superior to a solution made possible by perfect competition. The most obvious examples are the natural monopolies found in power

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[4]Lipsey, _op. cit._

utilities where only one plant (or a limited number) is needed to achieve lowest possible unit costs. While this one plant may operate much below its capacity, introduction of another plant will not increase competition but merely raise costs.

If workable competition is accepted as an ideal because a set of conditions is satisfied, the problem of social versus private goals can be satisfied by introducing a condition whereby an industry must satisfy social goals even if some immobility is built into the system as a result of this condition. For example, patents are awarded for successful new inventions even though these prevent complete mobility of factors or transmission of knowledge. An industry which has protection from many patents can be performing well. Its protection would arise from its ability to produce new products through continued research rather than barriers to entry imposed by the industry itself. Society has then placed the barriers to entry by disqualifying new entrants who do not have access to these patents.

The theory of imperfect competition, as it has developed since first being formally stated in the early 1930's,[5]

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[5] Robinson, J., op. cit., and Chamberlin, E.H., The Theory of Monopolistic Competition (Cambridge: Harvard University Press, 1933).

can be used to explain growth because of the built-in inequality of prices and costs. That is, prices can exceed costs even in the long run as long as some barriers to entry exist. This in turn allows firms to conduct research and invest profits in new plants. These profits may be (and uaually are) greater than profits for a comparable cost in a perfectly competitive industry because equilibrium can be established at prices other than those where prices are equal to long run average costs. Whether the advantages of having these excess profits outweigh the disadvantages resulting from the income distribution effects has to be determined separately for each case. If a firm can use its excess profits in such a way that welfare increases because the firm invests the capital rather than giving it to the consumer in the form of lower prices, society may consider some excess profits to be desirable.

Assuming that a third best solution which sets out certain conditions to be satisfied is the most desirable possible under the circumstances, the policy maker can proceed to see that this solution is achieved. The third best solution which could be considered workable in the petroleum industry could be stated in terms of certain magnitudes which the given indicators of performance would be expected to show. The resource allocation which would result if the

indicators were equal to the desired values would then be ideal from a practical standpoint. That is, this resource allocation would be better than any other allocation existing before implementation of certain policies. Ideally, a policy maker would want a whole series of conditions satisfied simultaneously. Since it is difficult to determine all the conditions which are needed and more difficult to continue satisfying several conditions over time, the more practical approach would be to implement a policy designed to satisfy one or more key conditions. While this is contrary to the theory of second and third best, satisfaction of key conditions may considered better than satisfying no conditions at all if the satisfaction of these key conditions increases aggregate welfare.

If welfare of society improves when certain conditions are satisfied, this means that performance of the industry is moving closer to a workable solution. By postulating that the marginal conditions do not have to be satisfied to achieve a third best solution, policy has to merely improve existing performance rather than try to achieve some ultimate goal for all time. Because of the dynamic nature of the economy, it is impossible to achieve a goal and remain

there for any period of time.[6] What is needed is not a strict definition of "good" performance but a policy designed to improve present performance where improvement means increasing the aggregate level of welfare.

Some bases of defining performance have been suggested. Unfortunately, these have led to introduction of vague goals which are difficult to achieve. An industry is performing well only if it is maximizing the welfare of society. This involves a measurement of welfare and introduction of a social welfare function. In turn, some method of determining what resource allocation pattern is deemed desirable must be worked out.[7] By stating the underlying value judgement that maximizing society's welfare is good, the policy maker can prescribe policy as long as he can measure the ultimate welfare level. Alternatively, he can prescribe policy which will increase aggregate welfare by making someone better off without making anyone worse off. Only the affected people must then be considered.

The better approach in analyzing what constitutes

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[6]Heflebower, R.B. "Toward a Theory of Industrial Markets", American Economic Review, XLIV (1954), p. 127.

[7]Sosnick, S.H., "A Critique of Concepts of Workable Competition," Quarterly Journal of Economics, LXXII (1958) uses terms like efficient, good, adequate, and excessive without pinning down the base to which these relative concepts are related.

good performance can be achieved by examining the structural characteristics of a market. The general statement which led to the discussion of workable competition was based on the structure aspect.[8] On this basis, good performance would be achieved when only a sufficient number of firms existed in an industry so that each could operate at outputs where little or no excess capacity existed and each had a sufficient share of the market so that operation of plants of long run optimum size would be feasible. While this may involve some excess profits, these could be acceptable if research expenditures increased as a result of the allowance for some excess profits.

To achieve a good performance, collusion and barriers to entry must be absent.[9] Mobility of factors of production is essential. Any policies which will increase existing immobility would then be considered as improving existing performance. Included are any predatory tactics designed to remove existing firms. In order to promote mobility of factors, information channels must be available to all. Thus, exchange of information must be allowed. This is presently being done through trade associations, research institutes,

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[8]Clark, J.M., op. cit. See also the discussion in Chapter V, Supra pp. 159ff.

[9]Stigler, G.J., "Extent and Bases of Monopoly," American Economic Review, XXXII (1942), 2-3.

seminars and meetings.

Besides considering the policy effects on the producing firm, the effects on sellers of factors and buyers of products must be examined. Ignorance on the part of the latter two groups can prevent the desired resource allocation even if the producing firm acts in the best interests of society.[10]

Performance of the petroleum industry in Alberta can be evaluated by assessing the level of performance as measured by various indicators and deciding whether improvements which raise the level of aggregate welfare can be implemented by designing policies to change the size of these indicators so that they more closely approximate some set magnitudes set out by the policy maker. Alternatively, the state of collusion, knowledge and mobility of factors can be examined and changes instituted where necessary. If it can be assumed that the indicators of performance set out are valid and can be measured in real terms, performance is then a weighted aggregate of the numerical value of these indicators.[11] This aggregate is not readily comparable with

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[10]Kahn, A.E. "Standards for Antitrust Policy," Harvard Law Review, LXVII (1953), p. 40.

[11]The underlying value judgement that it is a good thing for these indicators to assume a certain magnitude must be made. This magnitude will change with changing conditions.

aggregates from other industries or at other points in time because other things are seldom equal for two cases.

While it may be desirable to satisfy a set of conditions to achieve a third best solution, it may not always be clear which way one should move to bring about this satisfaction. That is, the realization that an indicator should have a different magnitude than the present may lead to a new policy. But, one has no definite insurance whether an improvement will occur unless it is possible to visualize the full shifting effects which could be caused as soon as forced changes in one of the indicators are contemplated.[12]

While good performance may entail satisfying a set of conditions, one has no guarantee that the resulting allocation of resources is the best obtainable. It is simply better than the set of conditions which were satisfied before implementation of the given policy. Existing performance as measured by using a series of indicators, should be used as a guide to postulate improvements rather than to conclude whether the obtained results are good or bad. The concept

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[12]That is, elimination of excess profits can be done by a taxing authority or sheer wasting of resources by the firm involved. If an excess profits tax is proposed, it is important to watch the firm's policy changes so that it does not try to change factor prices or selling costs. It becomes a matter for the policy maker to consider the alternatives and counteracting moves by the affected party before deciding what policy is best.

of workable competition could then become something which is never actually reached but towards which policies strive to push existing industries. The results achieved by an industry and measured in terms of profits, research, selling costs, etc. are useless unless one can decide whether welfare can be increased when resources are reallocated in such a way that some of the indicators change in magnitude.

Accepting the workable competition concept as being analagous to good performance would mean that satisfaction of the Paretian conditions is analagous with ideal performance. In other words, good performance is not ideal in the sense that a Paretian frontier is achieved but is the best possible in a constrained setting. It then becomes necessary to apply various tests to determine whether good performance is in fact being achieved. Whereas this study uses indicators to measure the level of performance, the behavior test has been suggested as a means of measuring the degree of collusion and immobility which can result in an industry.[13] This test assumes that the two extremes of monopoly and perfect competition are available. The actions of a firm are assessed in the light of accepted theory of monopoly and perfect competition. However, it is impossible to determine

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[13] Ibid., p. 41.

what level of profits, research, etc. a monopolist would be expected to have without more qualifying statements for each particular case. Some have argued that any degree of market power is bad *per se*.[14] With present notions of workable competition, this statement is true in the sense that market power is bad if abused in such a way that immobility prevents reallocation of factors for uses which will do most to maximize welfare. While too little competition is undesirable, too much may be undesirable as well if costs rise because firms cannot utilize existing plants in their most efficient manner or cannot build plants approaching long run optimum size.[15] Because this is so, the purpose of antitrust law can apply to assessment of performance. That is, the results alone do not determine the performance which one would want. It is necessary to examine why the results are being achieved.[16] Perhaps some of the results are short run phenomena which are occurring because an industry is pursuing long run goals of benefit to society.

The petroleum industry in Alberta has not been following a policy altogether consistent with maximization of

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[14] Burns, A.R., *Decline of Competition* (New York: McGraw Hill, 1936), p. 564.

[15] Kahn, *op. cit.*, p. 39.

[16] *Ibid.*

welfare in Alberta. If it has been, the smaller refiners could hardly be able to exist in an industry where costs are high for small capacity refineries. The price leader, being the low cost firm, has obviously not allowed prices to be governed solely by its own cost curves or the smaller refineries would have been unable to operate in the long run. If some method of pricing to reflect costs of each refiner were introduced, there is little doubt that some of the price rigidity now existing could break down. The low cost firm could force the higher cost firms out of the business.

Because price rigidity and price leadership have continued to be noticeable market traits in Alberta, one of several things can be concluded. Some degree of collusion continues to exist because the superiority of Imperial Oil continues to go unchallenged.

However, collusion need not exist. Firms may decide to follow a low cost price leader simply because it is in their best interests to do so. The decision to follow is made independently of other firms' decisions and not continue if the price leader is not satisfying some of the wishes of the "follower" firms. Price rigidity may have been caused by immobility of factors because consumers have been sufficiently ignorant or powerless to bring about price changes. Since the larger firms can use the threat of price wars, the

smaller firms may agree to follow policies of the large firms. Consumers may force changes in policies of the large firms if they can do so through sheer market power by refusing to patronize firms which charge "unjust" prices.[17] The most effective voices of the consumer are through the restrictive trades practices commission and the courts which administer antitrust laws. Since these have been interpreted rather loosely, little protection for consumers has resulted. Unless "undue" restriction of competition resulting in "unduly" high prices existed, the courts have failed to exercise their powers in prosecuting companies under the antitrust acts.

The Alberta petroleum industry has continued to operate without attaining a workable solution. Several factors could be responsible. The provincial government through tax and other laws has underwritten some of the risks of exploration, thereby reducing the costs of raw materials to the refineries not only in Alberta but elsewhere where Alberta crude is sold. This has helped to establish some facilities near the source of raw materials. Until pipeline technology became well perfected with the introduction of numerous feeding and looping lines which never affected main line pressures, many producers had to have easily reached markets to survive. Surface modes of transportation were costly so that many small refineries developed to service local markets. With the large

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[17]This is highly unlikely in the gasoline market where low substitutability of other products for gasoline prevent alternative goods from being used.

capital expenditures invested, many companies were loathe to service isolated markets from larger plants of minimum efficient size.[18]

To operate plants of minimum efficient size, some excess capacity has to be allowed because it is theoretically impossible to operate a plant of less than optimum size at its capacity without sacrificing efficiency in the form of lower costs.[19] With modern pipeline transportation, it is possible to locate refineries further from each other and utilize economies of scale to offset some or all increased transportation charges which result.

The existing size of refineries alone does not determine the state of competition and performance of the petroleum industry. Since most firms have widely held interests, regional investments can be manipulated at will to meet corporate objectives where necessary. Therefore, some of the price disparities presently noticeable between the Ontario and Alberta markets may have resulted from one company's decision to fulfill profits, production or other objectives and other firms' unwillingness to set prices other than those of the price leader.

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[18]Witness the only closures in recent history being the North Star refinery in Grande Prairie. Minimum efficient size is considered to be 30,000 b/d capacity for refineries producing a wide range of products. See <u>Supra</u>,p. 34. Optimum size is considered to be 120,000 b/d.

[19]That is, a plant of less than long run optimum size has to be operated in the short run at less than capacity if the long run envelope curve exists.

The solution to the problem is not easy. Overall assessment of the industry performance produces inconclusive results. While industry as a whole seems to be performing well because profits are reasonable, the larger and low cost firms have been extremely profitable. Removing several firms will probably decrease profits of the larger firms as they strive to capture a share of the new market made available but no statement about overall industry profits can be made. The precedence is seen in Ontario where several major refiners engage in very active price competition to capture and hold a share of the market. The danger of increased collusion as fewer firms remain in the market cannot be overlooked. If price regulation under the supervision of the Board of Public Utilities Commissioners is introduced, most of the collusion could be ruled out.[20] Whether this drastic step would ever be necessary is open to conjecture. The price inequity presently noticeable could very well disappear as smaller firms grow to challenge the leaders or as the leaders change their pricing policies. Regulation by antitrust laws may prove to be ineffective as well if regulated firms return to their old and perhaps vengeful ways after the initial effects of a restraining order are forgotten.

While present barriers to entry would have to be removed to allow free mobility of factors and knowledge, new barriers would in fact be imposed by allowing several select

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[20] Unless firms deliberately hold some of the product from the market, thereby forcing a rationing situation to develop.

firms to constitute the whole industry. However, these barriers exist only in the sense that the firms with the lowest costs operate and the rest are excluded. There is nothing to prevent a new firm from entering and forcing an existing firm out if it cannot operate after the new firm has disrupted the existing price structure.

Assuming that price regulation was preferred to antitrust legislation and the present situation, one has to examine the political repercussions. It would be difficult to regulate gasoline prices without regulating prices of other products which could be made from crude oil. Price discrimination among the various petroleum products would likely result as firms attempted to increase total profits lost through price regulation on gasoline.

The most desirable policy is to legislate in favor of some limited price regulation in the short run in the hope that an acceptable "competitive" price could be set by firms operating on the basis of cost considerations. The most urgent need remains in Alberta where presently wastage of capital exists because small firms continue to operate despite relatively high production costs. If some price regulation were imposed, the small firms would either be merged into larger ones or closed in favor of larger firms unless the integrated firms chose to adopt subsidies. More than likely, the firms would choose to operate larger, more economical, and likely, in the long run, more profitable operations. The important thing to remember, however, is that many of the repercussions

felt in Alberta presently are of a short term nature so that the inequities could well work out in a competitive market. It is always difficult to draw positive conclusions when studying an industry which perpetuates itself over a long period of time. Therefore, one must observe all of the actions over a period of time before positively making recommendations for change. The amount of information readily available does not presently allow such firm recommendations to be made. Rather, it should be concluded that the suggestions are alternative directions in which the policy maker can move if price discrimination between regions continues to exist.

TABLE A-I

TOTAL INPUTS OF MATERIALS, NET SALES OF PRODUCTS AND NET GASOLINE SALES FOR REFINERIES IN ALBERTA AND CANADA, 1940-1964[a]

Year	Total Runs to Stills ',000 barrels		Alberta Runs as % of Canada's	Net Sales of Products in Canada ',000 barrels		Alberta's Sales as % of Canada's
	Alberta	Canada		Alberta	Canada	
1964[b]	14,455	167,516	8.63	11,355	176,296	6.44
1963	31,186	331,514	9.41	25,487	337,391	7.55
1962	29,884	310,130	9.64	22,456	315,537	7.12
1961	28,460	297,818	9.56	22,581	303,537	7.44
1960	28,240	280,559	10.07	22,884	294,312	7.78
1959	28,694	269,825	10.63	22,290	274,913	8.11
1958	26,690	242,029	11.03	21,080	258,016	8.17
1957	30,426	241,066	12.62	21,309	251,311	8.43
1956	27,981	234,331	11.94	21,215	244,122	8.69
1955	23,054	195,993	11.76	18,000	214,375	8.40
1954	21,997	173,117	12.71	20,300	159,936	12.69
1953	23,066	158,342	14.57	21,222	146,037	14.53
1952	21,138	141,892	14.90	19,377	130,438	14.86
1951	17,279	130,427	13.25	15,990	126,140	12.68
1950	15,151	110,754	13.68	14,132	101,498	13.97
1949	. . .	98,501	. . .	11,373	89,309	12.73
1948	. . .	. . .	. . .	. . .	. . .	. . .
1947	. . .	. . .	. . .	. . .	. . .	. . .
1946	. . .	. . .	. . .	. . .	. . .	. . .
1945	6,353	67,468	9.42	5,806	59,884	9.70
1944	6,342	66,963	9.47	5,773	59,287	9.74
1943	5,838	60,901	9.59	5,360	54,166	9.90
1942	5,744	56,769	10.12	5,104	51,204	9.97
1941	5,083	60,029	8.47	4,688	54,473	8.61
1940	4,636	51,651	8.98	4,213	46,585	9.04

continued . .

TABLE A-I--Continued

Year	Net Gasoline Sales 1,000 barrels		Alberta's Sales as % of Canada's	Gasoline Sales as % of Net Sales of Products	
	Alberta	Canada		Alberta	Canada
1964[b]	5,970	55,090	10.84	52.58	31.25
1963	12,076	115,136	10.49	47.38	34.13
1962	11,426	108,494	10.53	50.88	34.38
1961	11,038	103,075	10.71	48.88	33.96
1960	11,155	101,205	11.02	48.75	34.39
1959	10,581	96,479	10.97	47.47	35.09
1958	10,018	92,137	10.87	47.52	35.71
1957	9,416	87,725	10.73	44.19	34.91
1956	9,204	83,020	11.09	43.38	34.01
1955	8,443	75,653	11.16	46.91	35.29
1954	9,367	68,927	13.59	46.14	43.10
1953	10,315	64,621	15.96	48.60	44.25
1952	9,157	58,320	15.70	47.26	44.71
1951	7,524	54,910	13.70	47.05	43.53
1950	7,174	46,159	15.54	50.76	45.48
1949	. . .	41,385	. . .	. . .	46.34
1948	. . .	. . .	. . .	. . .	. . .
1947	. . .	. . .	. . .	. . .	. . .
1946	. . .	. . .	. . .	. . .	. . .
1945	3,462	28,948	11.96	59.63	48.34
1944	3,177	26,375	12.06	55.03	44.49
1943	2,935	22,764	12.89	54.76	42.03
1942	2,899	20,546	11.41	56.80	40.13
1941	2,924	25,024	11.60	62.37	45.94
1940	2,965	23,361	12.69	70.38	50.15

[a]Source: Dominion Bureau of Statistics, Refined Petroleum Products (Catalogue No. 45-204, annual), Ottawa: Queen's Printer.

[b]January to June inclusive.

TABLE A-II

PRODUCTION AND VALUE OF CRUDE IN ALBERTA
PERCENTAGE OF NATIONAL CRUDE
PRODUCTION BY ALBERTA WELLS[a]

Year	Production in Barrels ('000)	Value at Well Head, $000)	Average Value/bbl. $	Value/gal. ¢	Alberta's Production as % of Canadian Production
1961	157,812	355,531	2.2538	6.44	62.12
1960	130,507	302,841	2.3205	6.63	68.86
1959	129,967	306,918	2.3615	6.75	70.34
1958	113,278	283,263	2.5006	7.14	68.45
1957	137,492	355,555	2.5860	7.39	75.61
1956	143,910	353,629	2.4573	7.02	83.68
1955	113,035	274,901	2.4320	6.95	87.33
1954	87,714	228,319	2.6030	7.44	91.29
1953	76,816	193,762	2.5224	7.21	94.95
1952	58,916	139,512	2.3680	6.77	96.21
1951	45,915	113,870	2.4800	7.09	96.43
1950	27,548	82,216	2.9845	8.53	94.85
1949	20,087	59,000	2.9372	8.39	94.28
1948	10,889	35,128	3.0998	8.86	88.62
1947	6,770	18,079	2.6705	7.63	88.01
1946	7,138	. . .	. . .	. .	94.09
1945	7,980	. . .	. . .	. .	94.07
1944	8,727	. . .	. . .	. .	86.41
1943	9,602	. . .	. . .	. .	95.52
1942	10,117	. . .	. . .	. .	97.62
1941	9,919	. . .	. . .	. .	97.88

[a]Source: Dominion Bureau of Statistics, The Crude Petroleum and Natural Gas Industry (Ottawa: Queen's Printer, annual).

TABLE A-III

PRODUCTION AND VALUE OF CRUDE IN CANADA[a]

Year	Production in Barrels	Value at Well Head, $	Average Value/bbl. $	Value/gal. ¢
1961	220,848	487,560	2.2077	6.31
1960	189,534	422,926	2.2314	6.38
1959	184,778	422,093	2.2844	6.53
1958	165,496	398,748	2.4094	6.88
1957	181,848	453,594	2.4944	7.13
1956	171,981	406,562	2.3640	6.75
1955	129,440	305,640	2.3612	6.75
1954	96,080	243,877	2.5384	7.25
1953	80,899	200,582	2.4794	7.08
1952	61,237	143,038	2.3358	6.67
1951	47,616	116,655	2.6499	7.57
1950	29,044	84,620	2.9135	8.32
1949	21,305	61,118	2.8687	8.20
1948	12,287	37,419	3.0454	8.70
1947	7,692	19,576	2.5060	7.16
1946	7,586	. . .	. . .	. .
1945	8,483	. . .	. . .	. .
1944	10,099	. . .	. . .	. .
1943	10,052	. . .	. . .	. .
1942	10,364	. . .	. . .	. .
1941	10,134	. . .	. . .	. .

[a]Source: Dominion Bureau of Statistics, The Crude Petroleum and Natural Gas Industry (Ottawa: Queen's Printer, annual).

TABLE A-IV

TOTAL GASOLINE PRODUCED IN CANADA, AVERAGE VALUE AT REFINERY AND AVERAGE PROVINCIAL ROAD TAXES[a]

Year	Quantity in '000 barrels	Gross Value at Plant in $	Average Value per barrel in $/bbl	Average Value in ¢/gal	Average Provincial Tax in ¢/gal
1961	104,989	542,749	5.1696	14.77	. . .
1960	101,382	520,956	5.1385	14.68	. . .
1959	95,499	498,706	5.2221	14.92	13.15
1958	89,310	619,267	6.9339	19.81	13.12
1957	86,268	599,141	6.9451	19.84	12.97
1956	85,815	548,717	6.3942	18.27	12.00
1955	76,642	491,186	6.4088	18.31	11.87
1954	68,503	439,106	6.4100	18.31	11.66
1953	63,725	348,123	5.4628	15.61	11.56
1952	57,878	322,836	5.5779	15.94	11.46
1951	52,264	296,590	5.6748	16.21	11.68
1950	45,335	265,666	5.8601	16.74	11.16
1949	40,737	230,265	5.6613	16.18	10.98
1948	. . .	. . . .	. . .	. . .	10.97
1947	. . .	. . . .	. . .	. . .	. . .
1946	. . .	. . . .	. . .	. . .	. . .
1945	26,675	107,055	4.0133	11.15	11.69
1944	24,668	101,785	4.1262	11.79	9.82
1943	. . .	. . . .	. . .	. . .	9.26
1942	. . .	. . . .	. . .	. . .	10.74

[a]Source: Dominion Bureau of Statistics, The Petroleum Products Industry (Catalogue No. 45-205, annual), Ottawa: Queen's Printer.

TABLE A-V

ECONOMIC ALLOWABLES OF SELECTED ALBERTA FIELDS WITH DATE OF CONVERSION FROM INITIAL TO OPERATING ALLOWABLES[a]

Field	Average Well Depth (ft.)	Initial Allowable bbl/d	Operating Allowances bbl/d	Conversion Date January 1, ____
Bonnie Glen	7,000	52	33	1962
Crossfield	6,700	50	33	1968
Fenn-Big Valley	5,300	40	28	1962
Golden Spike	5,750	43	30	1962
Harmattan-Elkton	9,100	74	41	1964
Innisfail	8,600	68	39	1965
Joarcam	3,250	30	25	1962
Joffre	7,000	52	33	1965
Judy Creek	8,650	68	40	1967
Kaybob	9,800	84	44	1965
Leduc-Woodbend	5,300	40	28	1962
Pembina	5,100	39	28	1962
Redwater	3,200	30	25	1962
Simonette	11,600	111	53	1967
Swan Hills	8,400	66	38	1966
Wizard Lake	6,450	48	32	1962

[a]Source: Alberta Oil and Gas Conservation Board.

TABLE A-VI

CONSUMPTION OF CRUDE BY LEADING REFINER[a]

Year	Consumption of Crude in '000 b/d	Total Canadian Consumption in '000 b/d	Leading Refiner Consumption as % of Canadian Consumption
1963	319	908	35.0
1962	305	849	35.9
1961	291	808	36.0
1960	284	761	37.3
1959	287	734	39.1
1958	272	658	41.3
1957	267	654	40.8
1956	283	634	44.6
1955	239	535	44.7
1954	217	469	46.3
1953	205	423	48.5

[a]Source: Imperial Oil Ltd., Annual Reports.

TABLE A-VII

REFINERY CAPACITIES IN ALBERTA, ONTARIO AND CANADA, 1942-1962 AND PRODUCTION AS A % OF CAPACITY[a]

	Alberta		Ontario		Canada		Production as % of Capacity		
Year	Crude Throughput in barrels/day	Capacity (',000's) year	b/d	',000 b/yr.	b/d	',000 b/yr.	Alberta	Ontario	Canada
1962	96,520	35,230	269,820	98,484	979,660	357,576	. . .	. . .	. . .
1961	91,620	33,441	267,900	97,784	960,310	351,473	85.11	86.19	84.73
1960	92,200	33,653	265,900	97,054	934,900	341,239	83.92	78.08	82.22
1959	90,200	32,923	264,850	96,670	868,300	316,930	87.15	78.75	85.14
1958	80,550	29,401	207,850	75,865	803,050	293,113	90.78	85.95	82.57
1957	84,450	30,824	201,350	73,493	766,500	279,773	98.71	79.49	86.16
1956	83,600	30,514	163,950	59,842	706,350	257,818	91.70	96.81	83.76
1955	77,900	28,434	148,850	54,330	625,100	228,162	81.08	94.28	85.90
1954	72,900	26,609	146,000	51,830	561,450	204,929	82.67	86.59	84.48
1953	70,100	25,587	119,500	43,618	509,300	185,895	90.15	87.92	85.18
1952	61,300	22,375	100,800	36,792	448,400	163,666	94.47	86.41	86.70
1951	60,550	22,101	79,400	28,981	411,250	150,106	78.18	. . .	86.89
1950	46,900	17,119	75,200	27,448	358,875	130,989	88.50	. . .	84.55
1949	43,200	15,768	83,700	30,551	336,825	122,941	. . .	. . .	80.12
1948	35,750	13,049	88,700	32,376	315,475	115,148	. . .	. . .	. . .
1947	21,300	7,775	87,950	32,102	261,925	95,602	. . .	. . .	. . .
1946	18,100*	6,607*	77,000	28,105	236,415*	86,291*	. . .	. . .	. . .
1945	18,100	6,607	75,450	27,539	231,215	84,393	96.16	. . .	79.95
1944	19,000	6,935	75,450	27,539	238,415	87,021	91.45	. . .	76.95
1943	18,400	6,716	76,250	27,831	242,215	88,408	86.93	. . .	68.89
1942	18,100	6,607	68,000	24,820	233,115	85,086	86.93	. . .	66.72

[a]Source: Dominion Bureau of Statistics, Petroleum Refineries (Catalogue No. 45-205, annual).

*Estimated.

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